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U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY—BULLETIN No. 46.

L. O. HOWARD, Entomologist.

PROCEEDINGS

OF THE

SIXTEENTH ANNUAL MEETING

OF THE

ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1904.

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L. O. Howard, *Entomologist.*

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A. D. Hopkins, *in charge of forest insect investigations.*
Frank Benton, *in charge of apiculture.*
W. D. Hunter, *in charge of cotton boll weevil investigations.*
A. L. Quaintance, *in charge of bollworm investigations.*
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E. A. Schwarz, E. S. G. Titus, *investigators.*
Miss H. A. Kelly, *special agent in silk investigations.*
R. S. Clifton, F. C. Pratt, August Busck, Otto Heidemann, A. N. Caudell, J. Kotinsky, H. S. Barber, *assistants.*
W. E. Hinds, W. F. Fiske, G. H. Harris, H. E. Burke, A. W. Morrill, J. C. Crawford, Jr., A. A. Girault, C. T. Brues, F. C. Bishopp, Springer Goes, C. M. Walker, *temporary field agents.*
Miss L. L. Howenstein, *artist.*

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1904

LETTER OF TRANSMITTAL

United States Department of Agriculture,
Division of Entomology,
Washington, D. C., March 3, 1904.

Sir: I have the honor to transmit herewith the manuscripts of the Proceedings of the Sixteenth Annual Meeting of the Association of Economic Entomologists, which was held at St. Louis, Mo., December 29–31, 1903. The papers presented at the meetings of this association are always of great economic importance, and the Department has hitherto published the secretary's reports of these meetings as bulletins of this Division. I therefore recommend the publication of the present report as Bulletin No. 46 of this Division. The two half-tone plates and one text figure are necessary to illustrate the text.

Respectfully,

L. O. Howard, *Entomologist.*

Hon. James Wilson,
Secretary of Agriculture.

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THE SIXTEENTH ANNUAL MEETING OF THE ASSOCIATION OF ECONOMIC ENTOMOLOGISTS.

MORNING SESSION, TUESDAY, DECEMBER 29, 1903.

The Association met in room No. 209, Central High School building, St. Louis, Mo., at 10 a. m. The following were in attendance:

C. C. Adams, Ann Arbor, Mich.; C. F. Adams, Lawrence, Kans.; A. F. Burgess, Columbus, Ohio; R. S. Clifton, Washington, D. C.; R. A. Cooley, Bozeman, Mont.; E. P. Felt, Albany, N. Y.; James Fletcher, Ottawa, Canada; G. H. French, Carbondale, Ill.; H. L. Frost, Arlington, Mass.; C. P. Gillette, Fort Collins, Colo.; E. C. Green, College Station, Tex.; C. A. Hart, Urbana, Ill.; J. S. Hine, Columbus, Ohio; L. O. Howard, Washington, D. C.; S. J. Hunter, Lawrence, Kans.; A. H. Kirkland, Boston, Mass.; Frederick Knab, Urbana, Ill.; C. L. Marlatt, Washington, D. C.; John Marten, Tolono, Ill.; G. W. Martin, Nashville, Tenn.; William Lochhead, Guelph, Ontario, Canada; Herbert Osborn, Columbus, Ohio; C. V. Piper, Washington, D. C.; E. D. Sanderson, College Station, Tex.; F. H. Snow, Lawrence, Kans.; J. M. Stedman, Columbia, Mo.; H. E. Summers, Ames, Iowa; O. H. Swezey, Columbus, Ohio; T. B. Symons, Collegepark, Md.; F. L. Washburn, St. Anthony Park, Minn.; F. M. Webster, Urbana, Ill.; E. V. Wilcox, Washington, D. C.

Owing to the unavoidable absence of President Slingerland, the meeting was called to order by the secretary, and Dr. James Fletcher was elected to preside throughout the sessions.

The presidential address, read by the secretary, was as follows:

INSECT PHOTOGRAPHY.

By M. V. Slingerland, *Ithaca, N. Y.*

A good photographic outfit is now one of the essential parts of every economic entomologist's equipment. The world's entomological literature now teems with illustrations from photographs. Some of our economic entomologists depend almost entirely upon photographs to illustrate their bulletins and reports. As I am one of the chief "sinners" in this respect, and as I am often asked how I do it, I have chosen the somewhat unusual topic of "Insect Photography" for my address to this Association.

HISTORICAL NOTES.

Probably it will never be known who first photographed insects. Photomicrographs were made more than one hundred years ago, and it is quite probable that some minute insects or parts of larger insects were thus photographed. It is doubtful, however, if living insects were photographed more than fifteen or twenty years ago, for there was little incentive for such work before that. But the commercial development in the early eighties of cheap mechanical engraving processes for reproducing from photographs or negatives opened a new and unlimited field for the camera. The establishment and equipment of the Hatch agricultural experiment stations throughout the country in 1888 offered greater facilities than ever before for work with insects, and this gave another great impetus and incentive to insect photography.

A few half-tone reproductions from photographs relating to insect work appeared in the publications of the experiment stations for 1888 and 1889; they represented the Cornell insectary, fumigation tents, photomicrographs of the hole made by the ovipositor of *Trypeta* [*Rhagoletis*] *pomonella* in apple skin, and ears of corn eaten by *Heliothis armiger* [*H. obscura* Fab.]. These early half tones were poor, and it was not until 1892 that many fairly good insect photographs were thus reproduced in the experiment station literature.

The Cornell experiment station began to use the Hatch fund in 1888, and under the direction of Prof. J. H. Comstock the first building of its kind, an insectary, was built and well equipped with photographic and other apparatus. The camera was soon in use, and Professor Comstock was probably one of the first to photograph living insects in this country. His first object was to print from negatives onto blocks for Mrs. Comstock to engrave, or to get prints from which to make drawings. Some of this work appeared in 1890 in a Cornell bulletin, but no half-tone engravings of insects or their work were used at Cornell until 1893. A good half-tone of nematode root galls appeared in an Alabama bulletin in 1889, and since that date the mycologists have well illustrated with half-tones the gross features of such diseases as potato scab, the smuts, rusts, etc.

The first half-tone engraving of a living insect that I have found in our entomological literature was printed in Entomological News for January, 1891. It is a very good picture of the "hickory horned-devil" caterpillar, taken in August, 1890, by Mr. J. F. Sachse. Much progress has been made since then by the makers of half-tone blocks and by the printers in using them. In 1892 Prof. L. H. Bailey had a photograph of the interior of a greenhouse full of plants returned to him by a plate maker, who stated that he could not make a good half tone, as there was too much detail. Ten years later the same photograph was again sent to be reproduced, and came out beautifully.

A GENERAL PROTEST.

To-day the camera has become the constant companion of many economic entomologists, and no phase of an insect's life, habits, or structure, alive or dead, is too minute or too active to be posed for a picture. Tested by both artistic and scientific standards, some of the results now appearing in our entomological literature have never been surpassed in insect illustration. But there is a lot of good printer's ink being wasted on very poor insect photographs. Sometimes a good photograph is not well brought out in making the half-tone plate, and often it is so poorly printed as to resemble a blotch of printer's ink rather than an insect. While we can not always remedy defects in making and printing half-tones from photographs, we can make better negatives oftentimes. Only a year or two ago a bulletin appeared with over 40 photographic illustrations, covering 20 full-page plates, and fully three-fourths of the "cuts" had little excuse for existence, so poor were they. The climax was reached in the final picture, just recognizable as a squash, which the author labeled "Eaten by millipedes, centipedes, and slugs, all of which were alive upon this at the time it was photographed, but as most of them were moving they are not plainly shown."

The best of photographers quite often get poor and worthless negatives, and anyone who attempts "hunting insects with a camera" will find this especially true. But my point is that such failures should go into the rubbish heap of experience rather than encumber our literature and degrade the standard of insect illustration. American economic entomologists lead the world in all that pertains to their subject; in our equipments and methods for investigation and experimentation; in our practical results; and let us maintain this standard in the illustrating of our literature.

A little more than ten years ago I was forced into insect photography by my inability to otherwise properly illustrate my graduating thesis. I have learned to appreciate a good insect photograph, but have yet to learn many of the "tricks" by which they are made. I find it is much easier to learn what not to do in photography than to discover just what to do. I have come to believe that "the man behind the camera" is largely responsible for many of the poor photographic illustrations of insects that get into print.

Some of the qualities of a good insect photograph are much detail; good backgrounds; evenly lighted and not too "contrasty;" taken from life is usually preferable, but not always possible; symmetrical or lifelike arrangement, if from dead specimens; and, lastly, artistic surroundings if practicable. Let me discuss the attainment of some of these qualities from my experience.

NECESSARY EQUIPMENT.

It is especially true in insect photography that first-class tools are necessary. My workshop, the Cornell insectary, is equipped with several cameras. For outdoor or field work the latest model of a 5 by 7 camera has recently been purchased. The photo-micro camera, shown in Pl. I, fig. 1, and an ordinary copying camera, shown in Pl. I, fig. 2, and several lenses complete the outfit. Instead of a simple copying camera, I would get an enlarging and reducing camera, with attachments for making lantern slides direct from large negatives. It costs at least $150 to properly equip an entomologist's studio for photographing insects. Our present outfit at the Cornell insectary has cost over $300, and nearly every division of the experiment station is also well supplied with cameras.

Nine-tenths of my insect photographs are taken with a large copying camera and an old 6½ by 8½ rapid rectilinear lens, bought in 1888. For making considerable enlargements with this camera a 3¼ by 4¼ lens that has a large diaphragm opening (which is indispensable in focusing) is the best I have yet used. I increase the bellows length, and thus the enlarging power of the copying camera, with a wooden hood, shown at *a* in Pl. II. One of the new photomicrographic objectives has just been purchased for enlarging minute objects. They are better for this work than ordinary microscopic objectives. We have different lens boards, so that all of our lenses can be used on the upright photo-micro camera, and it is often easier to photograph insects in a horizontal plane than to arrange them in a vertical plane for the copying camera.

On my trips throughout the State investigating insect outbreaks I usually take the field camera and rarely return without some interesting and valuable picture of an insect, its work, or methods of fighting it. I have even secured good flash-light pictures in an orchard at night of canker-worm moths crawling up the trunks of the trees.

THE WORKSHOP.

In photographing insects I want all the light possible to bring out the details, and so I work on the middle bench in the insectary greenhouse, where the light streams in from all sides. Usually I shut off the direct sun's rays from the object by putting a piece of paper near the roof, and thus I avoid practically all shadows. Sometimes shadows add an artistic touch to the picture, but more often they obscure or darken something more important. I have never tried lighting up an object with mirrors.

WHEN TO PHOTOGRAPH.

I often drop everything else to get a picture of an insect which is then in a certain stage or position that it may not assume again in a year. Choose bright days if possible. I have made some good pictures of insects by long exposures on dark or cloudy days, but I am satisfied that better results are obtained with shorter exposures on bright days.

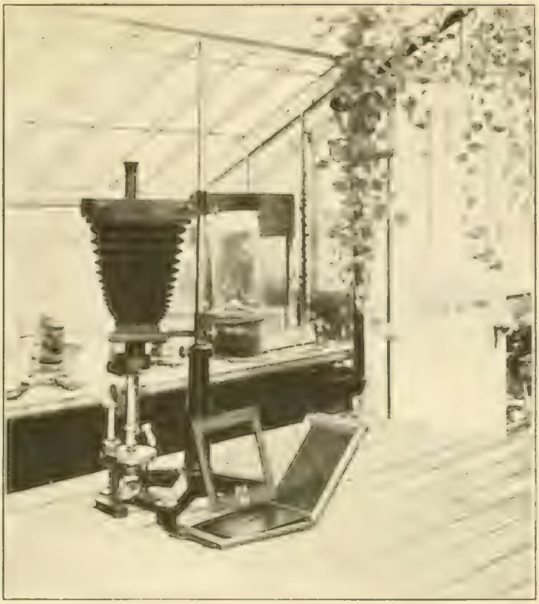

FIG. 1.—PHOTO-MICRO CAMERA IN OPERATION.
From photograph by author

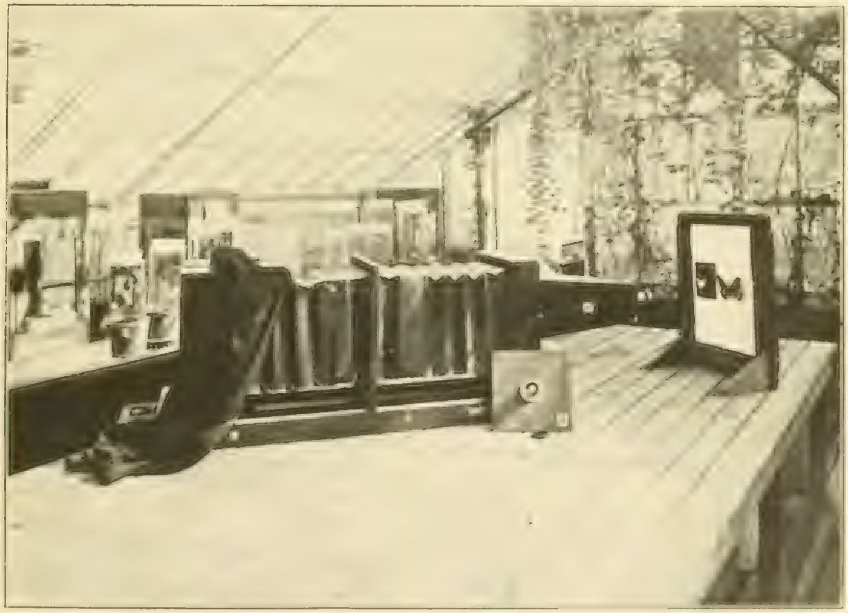

FIG. 2.—INTERIOR OF CORNELL INSECTARY, WITH COPYING CAMERA ARRANGED FOR TAKING AN ENLARGED PICTURE.
From photograph by author

PREPARING THE SPECIMENS.

Poorly prepared specimens spoil many an insect photograph. The value and beauty of the plates in Howard's Insect Book and Holland's Butterfly and Moth Books were greatly enhanced by the care used in selecting the best material and getting the wings, legs, and antennæ in as nearly symmetrical or natural positions as possible. I often spend more time in preparing a specimen than in photographing it, and the resulting half-tone always pays for doing it.

In photographing from life, of course, one can not always pose the insect, but I find that insects can be coaxed often into desired attitudes or positions by a little patient manipulation. To get sphinx, Datana, and many other larvæ in their characteristic positions it is often necessary to only jar the supporting branch just before exposing. I once coaxed three Myron sphinx larvæ into a row on a branch and then got them to all raise the front part of their bodies, thus reminding one of a "cake walk." A little pinch often keeps larvæ quiet a few seconds, and it is necessary with Papilio caterpillars to get them to project their osmateria. To get the best results, it is absolutely necessary to have the insect perfectly quiet for a few seconds.

Some insects are so restless or active that one can not pose them alive. In such cases I often kill them in the cyanide bottle, and after they become limp, arrange them as naturally as possible. The army-worms on the eaten corn plant in my much-used picture were brought 50 miles, killed, and stuck on the plant the next day with thick Canada balsam. I have also obtained in this way quite lifelike pictures from alcoholic specimens of larvæ preserved for a year or more. Patient and painstaking efforts of this kind are often repaid by very good photographs of otherwise impossible subjects. Sometimes I pin the insect in the desired position and paint out the pin on the negative or print.

BACKGROUNDS.

Smooth white paper furnishes most of my backgrounds. Tinted papers have helped me very little. Light-colored insects need a black background, and the best thing I have found for this is a piece of fine black velvet.

FOCUSING AND EXPOSING.

One can save much time by marking on the side bars of the camera the distance it is necessary to draw out the bellows to get an image natural size or twice or more enlarged. Our ground glass is marked off with a pencil into areas of the size of the different-sized plates used, so it is easy to center the image and determine what size of plate will be required. In the center of the ground glass we also cement with Canada balsam a large, square cover glass used on microscopic slides. This makes a small portion of the ground glass transparent, but with the focusing glass or eyepiece shown in Pl. I at *a* one can focus on this clear field more accurately than on the ground glass. This device is very useful when enlarging small insects. I always like to have a life-size picture of the smaller insects to use beside an enlargement instead of the usual hair line. One rarely gains much by enlarging insects which are an inch or more in size.

The proper length of exposure will have to be learned by experience, as it depends upon so many conditions, the rapidity of the plate, time of day, amount of light, magnification, etc. I usually expose an isochromatic medium plate about five seconds for a picture natural size under the most favorable conditions of light in my workshop. Several minutes are often required when considerable enlargements are made. I use regular photographic lenses as much as possible in enlarging, for they seem to give more detail and greater depth. Insects are usually photographed natural size or larger, and to do this well requires time exposures of from two seconds to several minutes. I can not get good detail and other necessary qualities with "snap shots;" I must have a second or two, even with instantaneous plates and good light.

I always use as small a diaphragm as possible (usually a No. 128 stop with opening about 7 mm. in diameter) under existing conditions of light, liability of objects to move, etc. In photographing large insects like the beetles, especially when enlarging them, it is absolutely necessary to use a small stop or some parts of the insect will appear out of focus in the picture; in other words, a small stop gives greater depth to the picture.

PLATES.

I now use isochromatic medium plates for most of my work. There is much in getting used to one brand of plates. I use some instantaneous plates for restless insects or outdoor work. And I find that for copying line-engravings or drawings plates made especially for such work give the best results.

COLOR SCREENS OR "RAY FILTERS."

These are sometimes indispensable in photographing many-colored insects like the butterflies and moths. I find, however, that in most cases the isochromatic plates give good color values, but certain colors, like those on the butterfly *Feniseca tarquinius*, require a color screen to bring them out well. I am too amateurish as yet to be able to determine from looking at an insect whether I had best use the screen. If I do not get a satisfactory negative without, then I put on the color screen. It is practically out of the question to use these screens in photographing living insects, for they lengthen the exposure from 15 to 18 times. I like the glass screens, adapted for special brands of plates, better than the liquid ray filters.

DEVELOPMENT, OR WORK IN THE DARK ROOM.

A properly exposed plate may be easily spoiled in the dark room. In insect photography, where detail is the essential element desired, the slower, contrast developers are better than the quicker ones used in landscape and portrait work. The following developer has given me good results for several years. It is also well adapted for lantern-slide making:

		Ounces.
I.	Water	10
	Sulphite of soda, crystals	8
	Hydroquinone	1
	Bromide of potassium	$\frac{1}{4}$
II.	Water	40
	Carbonate of soda, crystals	8

For use, mix equal parts of I and II.

Usually beginners do not develop long enough. Let the image come up slowly and gradually go back into the background. The appearance of the image on the back of the plate is often a good criterion when to stop.

For fixing I use a plain hypo bath of 1 pound hypo in 2 quarts of water, and I pour about a teaspoonful of acid sulphite of soda solution into a quart of hypo in my fixing tray. This acid soda prevents the hypo from discoloring for a long time and helps it to give clear, stainless negatives. I have had considerable trouble with other much more complicated acid fixing baths.

I have made but little use of intensifying solutions. I throw away thin negatives and try again. But I find a reducing solution an essential, especially in making lantern slides. I use an ordinary reducer, composed of 1 ounce of ferricyanide of potassium (red prussiate of potash) dissolved in 10 ounces of water. Pour a few drops of this into a little hypo fixing solution, dip the freshly washed negative or lantern slide in a hypo bath for a moment, then with a small brush use the reducer locally over the plate, washing out all muddy backgrounds or too dense spots.

MAKING PRINTS.

Make your own prints, for it is the most fascinating part of insect photography, and your negatives will get better care in your own hands. I have tried the "velox" and similar papers for making prints, but find that the "aristotype" papers, burnished on ferrotype plates, give me the most detail. With water colors or ink I often paint out pins or put in hairs on the finished print. I have never tried making very large bromide or other prints from smaller pictures or negatives, but some very satisfactory work has been done by the late Mr. V. H. Lowe and others.

NOTES ON PHOTO-ENGRAVING.

I often have slightly enlarged or much reduced half-tones made from my photos by the engraver. I used to send the negatives to the engraver, but some were lost or injured, and they now do satisfactory work from the prints. With these one can make various arrangements of several pictures in one half-tone. At one time I thought the half-tones were better when the backgrounds were not removed or cut away by the engraver, but now I have them cut out whenever practicable, as the picture usually stands out better when printed.

LANTERN SLIDES.

Most economic entomologists now have more or less teaching or lecturing to do, and illustrations are necessary, especially as it is often impracticable in large classes or audiences to use specimens. Large charts are very useful, but I find the lantern slides are a much more satisfactory and cheaper method of illustrating lectures. I was forced into the making of lantern slides of insects by classes too large to permit of using and breaking specimens, oftentimes a lack of specimens to illustrate the work of injurious insects, enough charts were too expensive, and there were practically no slides of insects on the market. Lantern-slide making is not a very difficult process. It can not all be absorbed from books, however, but must be learned in the school of experience.

Whenever it will serve the purpose I use a 3¼ by 4¼ plate in photographing, then a lantern slide can be easily made from it by simple contact exposure, as in making a print. One feels freer to destroy poor negatives and try again when these smaller and cheaper plates are used. A lantern-slide size negative can be made from a large print, but I prefer to make slides direct from the large negatives in the copying camera with lantern-slide attachments. Many negatives do not have density or blackness of background sufficient to prevent light getting through and making a darkish or muddy background on the lantern slide. I constantly use a reducing solution with a brush locally, as directed above, to clear up such backgrounds; it brightens up wonderfully an otherwise dingy slide. This local reduction is one of the most useful tricks I have learned about slide making. I save all discarded negatives that are thin enough and cut them into cover glasses for lantern slides.

Coloring, well executed, adds much to the beauty and value of insect lantern slides. To do this work properly requires high artistic ability in the management of colors, deftness in applying them on so small a scale, and an appreciation and intimate knowledge of the insect being colored. I believe the day is not far distant when we can photograph in colors by a much simpler process than that by which the admirable three-color work used in the Butterfly and Moth Books is accomplished.

CONCLUSION.

Finally, if I have given anyone a few hints that will help in the interesting and useful work of photographing insects, my aim is accomplished in preparing these rambling notes from my experience. Anyone who attempts this work must expect many failures, for there is no more elusive game than the insect world affords, but one good negative out of a dozen used in photographing a living insect is worth all the trouble. Except when the cap is off in exposing, one should have unlimited time in such work. I fully realize that it is now difficult for the economic entomologist to find time to investigate, experiment, teach, attend institutes, take care of insect collections, and answer a multitude of letters, to say nothing about eating and sleeping. Insect photography can not be done with a rush or in push-the-button style, but the camera must be ready at opportune times, and if one can not find the necessary time to make a good negative, it is better to illustrate in some other way. One can not do two or three other things and make good insect photographs at the same time.

The field before us is unlimited; manufacturers have placed at our disposal excellent instruments and plates; good prints are easily made; the engravers are becoming more expert in making the half-tone blocks; the printers can print good pictures if given suitable paper and no other alternative; therefore let the entomologists of America introduce the personal element necessary to eliminate the poor work and not only maintain the present high standard of our insect illustrations, but strive for still better things in the way of insect photography.

A general discussion of the address followed. Mr. Fletcher stated that far too many photographs were made of poorly set and imperfect specimens, and felt that greater care should be exercised by all entomologists in selecting material before it was photographed for the purpose of illustration. He called attention to the fact that many insects could be induced to remain quiet for a few seconds by simply blowing on them. In his opinion it was a mistake to omit the hair line, as many people unacquainted with insects would more readily know their exact size. A hair-line outline of the insect was very satisfactory.

Mr. Felt expressed his appreciation of the many valuable suggestions contained in the address, and stated that it was his custom as soon as he obtained a paper for printing photographs that gave good results to stick to it, as he did not have the necessary time to experiment with different kinds. Good equipment was also necessary in order to save time.

Mr. Sanderson stated that he had used isochromatic plates. For negatives of printed matter and objects without much color from which to make lantern slides certain kinds of dry plates were found satisfactory. It is often necessary to use a ray filter, especially to bring out such colors as orange. He also explained several devices which could be used to advantage in adjusting the plates.

Mr. Cooley used a plate holder which will hold any size of plate and is very convenient.

Mr. Washburn found it necessary to use a glass plate in order to avoid shadows.

The report of the secretary and treasurer was read and referred to the auditing committee appointed by the chair, as follows: Mr. J. S. Hine and Mr. C. A. Hart.

Mr. Webster moved that the chair appoint committees on programme, resolutions, nominations, and membership, and the following members were selected:

Programme: Messrs. Felt, Sanderson, and Gillette.
Resolutions: Messrs. Symons, Lochhead, and Sanderson.
Nominations: Messrs. Washburn, Felt, and Gillette.
Membership: Messrs. Osborn, Webster, and Felt.

On motion, an assessment of 50 cents each was levied on all members present at the meeting.

The following names were presented for membership:

Mr. George H. French, Carbondale, Ill., proposed by Mr. Webster; Mr. A. W. Morrill, Victoria, Tex., proposed by Doctor Howard; Mr. S. Arthur Johnson, Fort Collins, Colo., Mr. F. C. Bishopp, Collegepark, Md., and Mr. Estes Park Taylor, Champaign, Ill., each proposed by Mr. Gillette; Mr. Douglas B. Young, Albany, N. Y., proposed by Mr. Felt; Mr. P. J. Parrott, Geneva, N. Y., and Mr. O. H. Swezey, Columbus, Ohio, proposed by Mr. Burgess; and Mr. E. C. Green, College Station, Tex., proposed by Mr. Fletcher.

On receiving the report of the programme committee, a paper was presented, entitled:

THE USE OF ARSENATE OF LEAD FOR CONTROLLING THE CODLING MOTH.

By A. F. Burgess, *Columbus, Ohio.*

Early in the spring of 1903 a series of experiments was planned to test the effect of spraying for controlling the codling moth. This insect had proved very destructive in an orchard at Delaware, Ohio, and although some spraying has been attempted in previous years the applications were not made in a systematic manner and the insect had not been held in check. It had continued to increase in abundance, and the loss resulting thereby had become so serious that systematic treatment was rendered absolutely necessary if a profitable crop of fruit was to be raised.

The orchard consists of about 1,700 trees, 560 of which are just coming into bearing. The principal varieties are: Ben Davis, Minkler, Stark, Rome Beauty, Jonathan, Rambo, Grimes Golden, and Baldwin. Mr. Hudson kindly consented to making the tests and assisted in every possible way in carrying them out. A block of 100 trees was reserved for the purpose on the north side of the orchard; two rows on the west end of the block were Rome Beauty, the next seven rows were Stark, and the last row on the east end was Ben Davis.

CONDITION OF THE TREES.

The Rome Beauty trees were about 14 years old and had been top grafted. The Stark and Ben Davis were set at the same time, but the Stark trees would average considerably larger but not quite as tall as the Ben Davis.

The orchard had been kept in sod, but was not pastured, the grass being cut and placed under the trees as a mulch. Although the trees were trimmed late in the winter, the foliage on many of them was very thick, and, as they had been headed low, it was rather difficult to spray them thoroughly. All were infested to a greater or less extent with the San Jose scale and had been treated for that insect earlier in the season.

A severe freeze in early April killed a great number of the fruit buds, but many of the trees were heavy with bloom early in May. At that time (May 4) another severe freeze occurred, the temperature dropping to 28°, so that ice was formed on much of the bloom, and the prospects for a crop were nearly ruined. About one-fourth of a crop was harvested from the entire orchard.

After most of the windfalls had dropped an estimate was made of the entire crop remaining, and is shown in Table I. Each row contained 10 trees.

TABLE I.—*Estimate of crop remaining on trees after windfalls had dropped.*

Row No.	Entire crop would equal a full crop for—	Row No.	Entire crop would equal a full crop for—
	Trees.		*Trees.*
1	4	6	2
2	3½	7	4¼
3	2¼	8	3¼
4	1¼	9	4
5	2¼	10	[illegible]

The estimate at this time placed the yield of fruit at a little more than one-fourth of a full crop.

Rows 1 and 2 were Rome Beauty, rows 3 to 9, inclusive, were Stark, and row 10 was Ben Davis.

TREATMENT APPLIED.

Row No. 3 was left as a check and received no treatment.

Rows 4, 5, 6, and 7, all being of the Stark variety, were sprayed with Bowker's disparene or disparene and Bordeaux mixture, as is shown in Table II. In all cases the Disparene used was applied at the rate of 3 pounds, and the Bordeaux mixture was made by using 4 pounds of copper sulphate and 4 pounds of lime to each 50 gallons of water.

The treatment of these rows was placed in charge of two of my assistants, Mr. H. J. Speaker and Mr. Addison Hyde, both of whom have had long experience in applying insecticides, and are particularly careful and painstaking in their work. The first spraying was made by Mr. Speaker, May 8 and 9, and the last two by Mr. Hyde, May 22 and July 13.

Row 4 was sprayed with disparene as soon as the blossoms had fallen, and a second spraying with the same material was applied July 13, about nine weeks later.

Row 5 was sprayed in the same manner, except that Bordeaux mixture was added at the first spraying.

Row 6 received three sprayings with disparene, the first being made as soon as the blossoms had fallen, the second two weeks later, and the third on July 13.

Row 7 was treated in the same manner as row 6, except that Bordeaux mixture was added to the first two applications.

Rows 1, 2, 8, 9, and 10 were sprayed by Mr. Hudson immediately after the spraying was completed on the other rows. He treated the trees in his own way, and also sprayed the balance of the orchard. For the first two sprayings arsenate of lead was used, which he made from the raw materials, but for the third spraying the use of this material was discontinued and disparene was applied at the rate of 3 pounds to 50 gallons. Bordeaux mixture was used with the first and second spraying.

The formula used by him for making this arsenate of lead was: Thirteen ounces of arsenate of soda and 33 ounces of acetate of lead to each 50 gallons of spray. The salts were weighed out in these proportions and placed in paper sacks, so that they could be dissolved in separate quantities of water and placed in the spray tank when needed.

Table II.—*Showing treatment and date of application, also the number and percentage of sound and wormy apples.*

Row No.	First spraying.	Second spraying.	Third spraying.	Windfalls.		Picked apples.		Per cent wormy.		Per cent perfect.
				Wormy Aug. 4.	Wormy Sept. 23.	Wormy	Sound.	First brood	Second brood.	
1	Arsenate of lead and Bordeaux.	Arsenate of lead and Bordeaux.	Disparene	919	1,044	2,034	2,517	14	47	39
2	......do	......do	......do	874	845	1,534	1,926	17	46	37
3	No	No	No	2,428	1,359	1,172	376	46	47	7
4	Disparene .	No	Disparene	156	187	229	1,934	6	17	77
5	Disparene and Bordeaux.	No	......do	273	335	497	2,449	8	23	69
6	Disparene .	Disparene	......do	246	250	435	3,933	5	14	81
7	Disparene and Bordeaux.	Disparene and Bordeaux.	......do	468	554	864	4,417	7	23	70
8	Arsenate of lead and Bordeaux.	Arsenate of lead and Bordeaux.	......do	965	1,268	1,918	3,011	13	45	42
9	......do	......do	......do	876	1,407	2,824	3,094	11	51	38
10	......do	......do	......do	639	1,614	1,558	633	14	72	14

WEATHER RECORD.

During the time when the spraying was made the weather conditions were favorable, with one exception, as the days were warm and the wind was light.

The rainfall at Delaware, reported to Mr. J. Warren Smith, director of the Ohio section of the Weather Bureau, by the local observer, shows that no precipitation was recorded for over a week after the first spraying was applied.

On the afternoon of May 22, the day that the second spraying was made, 0.53 inch of rain fell, and this was followed by continued rain or showers on every day for the balance of the month, 1.73 inches being recorded during this time. The first half of the month of June was also very rainy, especially during the first week, the rainfall on the 6th amounting to 2.91 inches. The total for the month was 4.97 inches.

Very little rain fell in July after the 13th, which was the date of the third spraying. On the 18th 0.23 inch was recorded, and this was the largest amount on any day during the month.

From the fact that the foliage of the trees on rows 4, 5, 6, and 7 was well covered with poison late in September, it is probable that the July rains had little influence on the results of the last spraying.

AMOUNT OF MATERIAL USED.

The average amount of spray material used by us on each row was 35 gallons. During the second spraying on row 6 four nozzles were attached to a single spray pole, and 50 gallons were required to cover the trees. Row 7 was sprayed the same day, using three nozzles, and 35 gallons of spray were required. During the other sprayings a double Vermorel nozzle was used and an average amount of 35 gallons per row was applied.

Mr. Hudson used a little over 22 gallons per row.

COST OF TREATMENT.

Estimating the average amount of material used as 35 gallons per row, or 3½ gallons per tree, and counting the cost of disparene at 15 cents, copper sulphate at 6¾ cents, and lime at one-half cent per pound, the cost of material for treating this block is shown below in Table III.

The arsenate of lead made by Mr. Hudson is based on arsenate of soda at 8½ cents and acetate of lead at 10½ cents per pound.

TABLE III.—*Cost of material used in spraying.*

Row No.	First spraying.	Second spraying.	Third spraying.	Total cost.	Cost per tree.
1	Arsenate of lead and Bordeaux.	Arsenate of lead and Bordeaux.	Disparene	\$0.71	\$0.07$\frac{1}{10}$
2	do	do	do	.71	.07$\frac{1}{10}$
3	No	No	No		
4	Disparene	No	Disparene	.63	.06$\frac{3}{10}$
5	Disparene and Bordeaux	No	do	.83⅖	.08⅓
6	Disparene	Disparene	do	.94½	.09½
7	Disparene and Bordeaux	Disparene and Bordeaux	do	1.35½	.13½
8	Arsenate of lead and Bordeaux.	Arsenate of lead and Bordeaux.	do	.71	.07$\frac{1}{10}$
9	do	do	do	.71	.07$\frac{1}{10}$
10	do	do	do	.71	.07$\frac{1}{10}$

It is quite usual in reporting the results of spraying for the codling moth to ignore the amount of fruit that is ruined by the first brood of moths or make a general estimate of it. The picked fruit is then considered, and the percentage of wormy apples is based on the count of a few bushels from trees treated in different ways, or a general estimate is given of the amount of sound and wormy fruit.

As a matter of fact, the fruit continues to drop from the time the worms begin to feed until it is harvested.

In this experiment all windfalls were counted August 4 and removed from beneath the trees, and as examination showed that worms were present in the apples it was considered proper to class this fruit as having been destroyed by the first brood of moths.

All the fruit remaining on the ground under the trees was removed and counted before harvesting began and, together with the wormy picked fruit, was considered as having been attacked by the second brood. Upon these counts and the counts of the sound apples picked and blown to the ground, the table of percentages is based.

SUMMARY.

In considering the final results of this experiment, several important facts should be borne in mind:

First. The orchard had never before been systematically treated, and only a partial effort had been made to control this insect.

Second. The crop was very small, thus giving the fruit very little opportunity to escape attack. The same conditions as to the crop prevailed in an adjoining orchard and although systematic spraying was applied, as has been the case for several years, the number of wormy apples was unusually large.

Third. The weather late in May and early in June was very wet, and this may have caused the second spraying to have done a minimum amount of good.

Fourth. In the light of the results which show a very large amount of damage by the second brood of moths, it may be that more effective work would have been accomplished if the third spraying had been made a week earlier in July.

July 13, the date on which the spraying was made, is about as early as it is usual in this latitude to apply the third spraying. According to Riley, the second brood of the moth emerges in the latitude of St. Louis about July 8. As Delaware is about 125 miles north of that latitude, an application of poison on the 13th should be in sufficient season to protect the fruit from this brood. Unfortunately I was unable to determine the exact date of emergence of the second brood, but I am informed by Mr. Lowell Roudebush, one of the progressive horticulturists of Clermont County, which is in the southern part of the State, that he observed specimens of the second brood in his orchard at Nicholsville on July 7, 1902, and on July 12, 1903.

The materials used by us were of known strength, but the arsenate of lead[a] applied by Mr. Hudson depended on the purity of the raw materials that were obtained. This will always be the case with homemade preparations unless a definite guaranty of the chemical purity of the ingredients is required.

COMPARISON OF RESULTS.

It will be observed that on the check row 46 per cent of the fruit was ruined by the first brood and 47 per cent by the second brood of the codling moth. The remaining 7 per cent amounted to about 2 bushels and was small and imperfect. Had no spraying been done in this orchard scarcely any marketable fruit would have been harvested.

A comparison of the percentages of perfect fruit on the rows which were treated three times and those that were treated twice shows a slight increase in favor of three treatments. In this experiment the difference is not marked enough to warrant the expense of an additional treatment. The prevailing wet weather immediately following May 22 may have been responsible for this state of affairs.

It will be noted that the per cent of wormy fruit was considerably greater in each case where Bordeaux mixture was added. The results of an early and late spraying on rows 4 and 5 show an increase of 8 per cent of wormy fruit where Bordeaux mixture was added to the first application, while on rows 6 and 7, where three sprayings were made, an increase of 11 per cent of wormy fruit occurs where this mixture was added to the first and second spraying. Apparently this phase of the treatment is worthy of further trial and consideration, as the results of a single season's work should not be accepted as conclusive evidence that the addition of Bordeaux mixture to poisonous sprays diminishes their effectiveness.

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[a] An analysis of the acetate of lead and arsenate of soda used by Mr. Hudson, and also by the owner of the adjoining orchard, Mr. Vergon, in preparing this material, was made by the official chemist of the Ohio State board of agriculture. His report, which was received since the presentation of this paper, states that the arsenate of soda contained 25.9 per cent of salt; hence it was very impure.

On row 6, where no Bordeaux mixture was applied, several trees near the north end were quite badly affected by apple scab. The other trees on the same row were only very slightly affected with this disease and to no greater extent than the trees where Bordeaux mixture was applied.

The results of the spraying by Mr. Hudson show a favorable increase when compared with the check row. This spraying was considerably less successful in holding the insect in check than the treatment that we used with disparene, as will be observed in Table II. This may in part be due to the quality of the poison applied.

Mr. Gillette stated that he was much interested in the spraying experiments for the control of the codling moth, as he had studied this insect for several years. He had used arsenate of lead recently in Colorado with good results. It was coming into very general use in his State. He called attention to the large percentage of wormy fruit on the check row, but stated that he believed that if the check trees had been at a considerable distance from the treated trees the amount of wormy fruit would have been larger. He was inclined to think that many of the fruit growers in Colorado were using too large an amount of lime.

Doctor Fletcher considered that entomologists should be very careful in making recommendations to dispense with Bordeaux mixture when spraying for the codling moth, as, in his experience, it had been exceedingly beneficial in holding several diseases of the apple in check. The "black spot" of the apple causes great loss to the growers in Canada and has been effectually controlled by adding Bordeaux mixture to the spray when treatment was made for the codling moth. He found that its addition usually decreased the effectiveness of the poison a little, but he would not favor leaving it out even if a considerably larger per cent of fruit than is the case were found wormy, as mentioned in the paper under discussion.

Mr. Gillette remarked that he had been able to recognize only two broods of this insect in Colorado, and that where he had made three sprayings he had, in one case, reduced the number of wormy apples to 1.6 per cent, while the check block had 31.6 per cent wormy.

Mr. French stated that a fruit grower near Carbondale, Ill., had been in the habit of spraying his apple trees eight times during the season with white arsenic and soda (carbonate of soda), and for the past four years had found only an occasional wormy apple. Some trees of the Winesap variety were sprayed last summer eight times with arsenate of lead, using 3 pounds to 50 gallons of water, and the fruit on these trees was one-fourth to one-half smaller than that on the trees treated with the other material.

Mr. Sanderson thought that this might be due to the fact that arsenate of lead would adhere better to the fruit, and that the trees had been oversprayed. He also spoke of the necessity of making accurate counts of all the wormy fruit and taking into consideration the apples that dropped to the ground early in the season, as well as those found on the trees at the time of picking, and gave the following summary of his experiments in Delaware:

(1) Arsenate of lead (disparene), 1 pound to 50 gallons, gives from one-third to one-half more in perfect picked fruit than arsenites of lime or soda, Paris green, or green arsenoid.

(2) Paris green or green arsenoid, 1 pound to 160 gallons, and arsenites of lime or soda, 1 gallon to 160 gallons, are practically of equal value.

(3) The addition of more arsenite than the above strength is unwarranted.

(4) Spraying three times does not give enough benefit to warrant the third spraying if the first two are properly made.

(5) It is doubtful whether the addition of adhesives is profitable.

(6) The addition of 15 per cent or 20 per cent 150-test kerosene is not deleterious to the insecticidal value of the arsenite or the fungicidal value of the Bordeaux mixture, but the same strength of crude petroleum can not be recommended for use when spraying for the codling moth.

(7) A benefit of from 25 to 75 per cent is derived from spraying as regards the amount of fruit dropped, varying with the season and spray.

(8) The benefit derived from spraying increases in direct ratio as the per cent of dropped fruit and the per cent of wormy fruit on unsprayed trees. (Thus with 56 and 60 per cent wormy fruit and 69 and 56 per cent dropped in 1902 and 1901, respectively, on Winesaps, there was 112 to 186 per cent benefit to the perfect picked fruit sprayed with disparene; 70 and 87 per cent with arsenites of soda and lime in 1902, and 120 per cent with Paris green in 1901; while with an average of 25 per cent wormy dropped on Stark and Nero in 1902 there was but 30 to 37 per cent benefit to perfect picked fruit.)

(9) In the same orchard and variety the per cent of perfect fruit dropping is practically the same whether sprayed or unsprayed, the amount of dropped fruit depending upon the percentage of droppings wormy.

(10) The benefit derived from the spraying lies in increasing the amount of picked fruit and decreasing the amount of wormy droppings, and only partly in decreasing the percentage of wormy picked fruit.

Mr. Piper suggested that all the fruit that dropped must not be considered as loss, because in many seasons the fruit on the trees should be thinned in order to produce a large and perfect crop.

Mr. Cooley agreed with Mr. Piper on this point and stated further that in Montana the problem for controlling the codling moth was to prevent its spread into the large commercial orchards, and this was being attempted by spraying in the affected districts.

Mr. Lochhead stated that in Ontario one brood only of the moth exists east of Toronto, while two broods are present annually west of that point; he considered spraying essential in the eastern section, and spraying and banding the trees with burlap to be most satisfactory in the western part of the district. The chief difficulty was that many of the orchardists failed to examine the burlap bands regularly and carefully, and in this way many of the moths developed and escaped. In answer to a question of Mr. Sanderson as to the cause of the different number of broods, he replied that the climate of Ontario was peculiar, inasmuch as the two districts alluded to were located in different life zones, and that this fact would undoubtedly explain the difference in the number of broods.

Doctor Fletcher did not think it advisable to leave check trees in experimental orchards—there were only too many orchards which were not sprayed which could be used for comparison—and recommended spraying five times, but stated that where he had sprayed only twice in eastern Canada fairly good results had been obtained. He expressed the opinion that many apply the first spraying too early and that it is not necessary to make this treatment until a full week after the blossoms have fallen. During this season a severe drought had apparently checked the damage done by this insect in eastern Canada. The second brood was the most difficult to treat, and he had advised spraying in the East and the use of burlap in addition to spraying in the West, as had been stated by Professor Lochhead.

Mr. Gillette remarked that this insect passed the winter in the larval stage and that he had never discovered it in any other condition at that season of the year.

Mr. Piper spoke of the conditions in the State of Washington and expressed the opinion that the destructiveness of this insect depended largely on the life zones in which it was found. There were still many problems concerning it to be solved. In the valleys where the San Jose scale existed in many of the orchards the codling moth was also present. He had advised four or five sprayings and stated that Mr. Aldrich believed that there are three broods of the moth in some parts of the State.

Mr. Sanderson said that the insect was somewhat variable in regard to the number of broods in Delaware and that he had been able to demonstrate that in some cases only one brood existed. He found that larvæ collected August 10 had passed the winter without pupating. In Texas this insect was very destructive to pears in the vicinity of El Paso.

Mr. Gillette reported having found the second brood of moths as early as July 12 in Colorado, at Grand Junction, and Mr. Cooley had concluded from his experiences in Montana that there were two broods annually and probably no more. Mr. Gillette had found that the first brood extends over about sixty-nine days—that is, the moths from this brood have continued to emerge for that number of days at Fort Collins.

Doctor Fletcher called attention to the fact that the difference in the time of hatching of eggs is very common in nature. Ten days' difference in the time of egg laying might have considerable bearing on the date of maturity of the progeny. Larvæ hatching early might mature the same season, while later individuals would go over the winter. He referred to the fact that Mr. C. B. Simpson had proved that the larvæ of the codling moth were able to develop on the leaves of apple trees and that this would give the insect a chance to be carried over in case the fruit crop was a failure.

Mr. Gillette cited an instance that had come under his observation, where a hailstorm, late in May, removed all the fruit from the trees. During the next two years the apples in orchards that were in the area covered by the storm had been almost entirely free from worms, while orchards lying just outside this area had their apples badly infested.

Mr. Cooley expressed the opinion that this moth was very susceptible to changes in temperature in the spring, and that this accounted for the overlapping of the broods. He had placed an unimpregnated female moth in a bottle in his refrigerator, and after two months it had been removed and placed in a window during a warm day. The moth revived and at first was very active, but died after a short time.

Mr. Sanderson suggested that the second spraying be made a little later in the season and believed that it would give better results.

The next paper presented is as follows:

A NEW ENEMY TO THE PLUM, DIMORPHOPTERYX PINGUIS.

By James Fletcher.

[Withdrawn for publication elsewhere.]

AFTERNOON SESSION, TUESDAY, DECEMBER 29, 1903.

The meeting was called to order by Doctor Fletcher, and the following paper was presented:

SOME ECONOMIC CONSIDERATIONS WITH REFERENCE TO THE TABANIDÆ.

By James S. Hine, *Columbus, Ohio.*

An interesting entomological study is that which has for its object the separation of beneficial and injurious species, but it is safe to say that one is almost sure to meet with perplexing questions when he undertakes a study of the kind. Some statements bearing on the matter regarding the Tabanidæ have appeared from time to time in the literature of economic entomology. If I understand the situation, some hold that it is not advisable to attack these insects in the immature stages on account of the predaceous habits of the larvæ. So far as the study of this latter stage has advanced, all that bears on feeding habits indicates that they are as apt to feed on beneficial as injurious forms; and since the remedies for horseflies in any stage are, to a degree, unsatisfactory, it seems best to pursue any mode of attack that offers results without reference to the stage in which the attack is made.

By studying the egg-laying habits of different species, it is revealed that there is a certain uniformity in regard to the matter. *Tabanus stygius* Say, in the locality where I have studied it, places its masses of eggs on the leaves of Sagittaria almost altogether, and since these plants have a tendency to grow in patches, one often finds a small area where these eggs are very abundant, while but a short distance away where the plants may not be growing scarcely any are to be found. A few counts of the number of eggs composing a mass are of interest. Twenty masses of *Tabanus trimaculatus* averaged over 500 eggs each, and several masses of *T. stygius* averaged almost as many. From a desire to know how many eggs could be collected in a given time, I have found that it is easily possible to find places where as many as 60,000 may be taken in a single hour. Therefore it looks reasonable that some method of gathering the eggs might produce good results, especially when we consider the large size of the masses and the fact that these masses usually contrast very strongly in color with the objects to which they are attached. And again, a small area of marshy ground or stagnant water in some regions may be the only location in a large scope of country that offers favorable conditions for the oviposition of the Tabanidæ.

It is not to be supposed that an account of the habits and life history of one species will furnish facts which may be applied in all particulars to the other members of the family. A careful study of each species is almost sure to bring out striking differences, and it is this fact that makes their study interesting and instructive. Eggs may be placed in different situations, for example, over water or over mud, usually according to the species; but at other times it seems according to circumstances. Some species are known to habitually attach their eggs to projecting stones in ripples, others to foliage or any projecting object over stagnant water. It appears that the commonest species and at the same time the worst stock-pests oviposit over stagnant water or over wet ground. Larvæ hatched from eggs placed over water must drop into the water, and therefore a measure of success may be had by using contact insecticides on its surface at hatching time.

The method so long used of applying some oily or ill-smelling substance to stock for the purpose of repelling the flies has certain virtues that should not be lost sight of, but a single application is of such short duration and the objection to making such applications to animals so common that if any other equally effective measures could be brought out the former would become unpopular.

Since the injury caused by horseflies is produced only by the adults, a remedy for this stage is most desirable, and it is to be hoped that a careful study of the habits of this stage may reveal points where successful attacks may be made. Porchinski, of Russia, and Howard, of this country, have already made a notable contribution along this line; and besides, the habit which the adults of some species, at least, have of collecting in certain situations seems to offer promise of good results. In the few experiments I have made in this connection it has been demonstrated to my satisfaction that it is possible to get good results by systematically trapping the adults.

Mr. Washburn stated that he had been requested to advise some satisfactory remedy to prevent the attack of these flies upon horses in the rural districts. In at least one place rural mail delivery had been suspended at certain seasons of the year on this account, and he asked if fish oil and lard or lard and kerosene had been found satisfactory as a remedy.

Mr. Hine replied that undoubtedly these materials were of some value, but that they must be applied very often to the animals.

Mr. Fletcher remarked that he had seen plowmen in plowing matches in Manitoba spray their animals with kerosene emulsion, and that this is more effective if a little carbolic acid is added to the mixture. He knew of but one instance where animals treated with kerosene had been injured by the application. This was on rough, long-haired animals.

Mr. Washburn said that he had recommended for the horn fly a mixture made of 1 pint of kerosene and 3 pints rancid lard, and that this this worked well, the effect lasting twenty-four to forty-eight hours.

Mr. Fletcher used 1 pound of pine tar in 5 pounds of lard, but few people could be induced to use lard and pine tar on their animals, although they were good remedies, for the reason that they left the hair in a very dirty condition.

Mr. Marten stated that kerosene could be used on the human scal if the hair is loosened up and left so that the material will evaporat quickly. In case evaporation is retarded, injury is likely to follow.

The next paper presented was as follows:

THE CARD-INDEX SYSTEM FOR ENTOMOLOGICAL RECORDS.

By E. Dwight Sanderson, *College Station, Tex.*

At several previous meetings of this association descriptions of entomological records have been given by Messrs. Forbes, Hopkins, Webster, and Ball,[a] and their merits discussed.

No one system will probably ever be devised which will meet the needs of all, but often by comparing methods we can secure suggestions of value. In taking charge of the work in Texas I found that a system of notes must be established, and proceeded to devise the scheme outlined, based almost entirely on a similar system which I had given three years' trial at the Delaware station. In looking over the papers above mentioned I am struck with the fact that in very many respects my methods are the same as those of others, which is somewhat of a recommendation. Though the following system is original, therefore, still it has been the result of the study of the strong and weak points of other records, and thus resembles them in many essential respects.

All of our records are kept in card drawers for 3 by 5 and 5 by 8 cards. The duplex punch and split guide rods are used. Several different files are kept of these two sizes. A great part of our records are of material received through the mails. Let us take an instance and follow it through the records.

CORRESPONDENCE RECORD (3 BY 5 CARDS).

When a card is received it is at once stamped. The date of receipt and answer is indicated. On the next line is indicated under what letter or name it is to be placed in the letter file. I find this necessary with the office help we have. The next four lines give spaces for indicating the county, crops, literature sent, and subject of letter. These lines refer to a card of the correspondence file. Every correspondent is given one of these cards and they are arranged alphabetically, under towns, according to the names of the correspondents, the towns under counties and the counties alphabetically. Guide cards can be purchased ready printed of the counties and leading towns. On this card is given the name of the correspondent, town, and county. On the next line is given the crops in which he is interested, as far as we can learn. This is for using the file as a mailing list. In sending out a circular we mail only to those parties interested in that crop. Or often we wish to know some fruit or truck growers in a certain county and can secure their names by running over this file. Below is a record of literature sent the correspondent and the dates and subject-matter of letters sent to and received from him.

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[a] S. A. Forbes, Insect Life, Vol. II, p. 185, 1st meeting Assn. Econ. Ent.

A. D. Hopkins, Insect Life, Vol. VI, p. 103, 5th meeting Assn. Econ. Ent.

F. M. Webster, Bul. 20, n. s., Div. Ent., p. 46, Proc. 11th meeting Assn. Econ. Ent. Also Bul. 114, Ohio Ag. Exp. Sta.

E. D. Ball, Bul. 31, n. s., Div. Ent., p. 37, 13th meeting Assn. Econ. Ent.

Also see Comstock's Insect Life.

FOOD PLANT RECORD (3 BY 5 CARDS).

The stamp on the letter also contains blank for the food of the insect and the scientific name of the pest, together with number of accession to collection and experiment number, if any. These items are first entered on the Food Plant Record. This is on 3 by 5 cards. These are arranged alphabetically according to food plants and genera. All accessions to the collection and records of injury to various plants are recorded on these cards, each insect being given a different card. Thus at a glance we can secure a reference to all notes and specimens of all insects recorded as affecting a given plant. On each card is indicated the position of insects affecting that plant in the economic collection.

ACCESSION CATALOGUE (3 BY 5 CARDS).

If specimens which are to be preserved accompany the letter they are given a number in the accession catalogue. This is recorded on 3 by 5 cards. Each accession is given a separate card, the cards being numbered consecutively with a numbering stamp. This card gives the name, number of specimens of each stage of the insect and its work, date and place of capture, food, collector, and notes. At the bottom are spaces for indicating the family and order of the insect. This is to enable a clerk unfamiliar with the classification to record the species on the distribution map to be explained below.

All accessions are entered on the food catalogue, after which the space on the accession catalogue marked "Food catalogue" is checked. In the same way the accessions are entered on the distribution map and the space on the accession card checked when so entered. A blank on the accession card is left to indicate the name of the party determining the species. In case this is some specialist at a distance, the card is sent to him so that he can secure the full record of the specimen, and he then signs his name in this space upon determining it. In a space marked "Preserved" is indicated by abbrevations the manner in which the specimen is preserved and after "Col. No." is given the number of the block on which the specimen is to be found in the economic collection. This number is similar to the number of a library book catalogued by the decimal system, and will be further explained later.

By having a card for each accession, and the cards numbered by machine, a number of men may be assigned a series of numbers without having to refer to each other. Thus one is given cards numbered

100 to 199, another 200 to 299, etc. When these are filed another series is taken. Furthermore, it is not necessary to encumber the work table with a bulky volume or to refer to it for the next number, as the first blank card is already numbered. For the accession catalogue we are now also using a book, the only one in use. This is a large volume with the pages 12 by 18 inches, having columns headed as follows from left to right across two pages: "Accession number," "Experiment number," "Species," "Locality," "Date," "Collector," "Remarks." This book was in use upon my coming to the office and will form a duplicate and complete record of all accessions. It will be noticed that it does not provide for all the data on the cards. By having this book cards can be sent with specimens to specialists for determination, and if not returned the record is intact, and cards written up by an assistant may be kept by him at his desk and yet have the whole record complete. The book record may be easily copied from the cards by the office clerk every week or so in a few minutes. It is quite possible, however, that we will discontinue this book record entirely after further trials, as it is not necessary. In the lower right corner of the correspondence card is a space—"Exp. No."—for number of experiment of this species. This refers to the number under which notes upon this species may be found in "Experiment file." The word "experiment" is possibly a misnomer in this connection, having reference more to studies of the life and habits than to experiments with remedies in most instances. But in want of a better term, and as this is used with this significance by many, it serves the purpose as well as any.

EXPERIMENT RECORD (5 BY 8 CARDS).

Were it desirable to enter upon a study of the sweet-potato weevil, or had we already done so, it would have an experiment number, in this case 17. In the experiment file notes on various species are arranged on cards or slips under guide cards bearing the number of each. The guide card bearing the number contains blanks for recording a brief account of the notes upon the species when the study has been completed or when it is desirable to make a résumé. On it are to be found all the accession numbers of that species. At such a time the notes for a given period are transferred to the systematic file and the guide card left with the last date of notes transferred upon it, and a new guide card started for subsequent notes. Additional subguides are often used to separate notes being taken at different points or on different phases of the study, such as insectary, field notes, insecticides, etc. All notes upon any species having an experiment number are filed under that number. A card index on 3 by 5 cards arranged alphabetically enables us to secure the experiment number of a given species at a glance, as does a similar list in an indexed pocket memorandum book. Practically, one remembers most of the numbers until they become quite numerous. Also in the experiment file are kept prints of all negatives taken of the species concerned, with numbers referring to their position in the negative file.

SYSTEMATIC FILE (5 BY 8 CARDS).

Had the letter referred to some insect of which no special study was being made, but of which we wished a record of the information given, a note would have been made of it in the systematic file, on a card or slip the same as used in the experiment file. These 5 by 8 cards or slips are all punched for duplex rods and are used for all notes in the field or laboratory. The systematic file, as its name indicates, is arranged alphabetically, according to the systematic classification of insects. Large buff guides show the orders; small blue guides, the families; white guides, genera where notes or many species occur, and sometimes a tab card is used to indicate the location of notes on a species upon which many observations are made. Each group is arranged alphabetically under the next larger systematic group. A strictly systematic arrangement, as in a collection or check list, is not feasible, as the notes must be entered by a clerk not familiar with classification. Where a note is made upon an unknown species, which is not given an experiment number, it is given an accession number, which is placed on the note slip attached to the breeding cage. In case the species is still undetermined when the slip is to be filed it is placed under the smallest group to which its classification can be traced just after the guide card of that group. In this file are also kept occasional notes or suggestions regarding insecticides, machinery, etc., each under its own guide card.

At the beginning of notes on each species of economic importance—i. e., found in the economic collection—is placed a double card 8 by 10 inches folded to be 5 by 8, bearing an outline map of Texas on the inside, known as the distribution map. These maps can also be used for any species of which we wish a graphic record of its distribution, such selection of species being entirely arbitrary. For most States a card 5 by 8 would hold a map of the State on the same scale. Practically all specimens of a species not of economic importance are to be found in the systematic collection, so that its distribution can soon be ascertained by examining the locality labels on specimens. As it is impossible to write out or have printed on the map the name of each locality, the locality from which the insect is secured is indicated as nearly as possible by placing a number at the proper point in red ink. On the back of the card this number is recorded, and after it are given the post-office, county, collector, date, and accession number of the specimens. All specimens or new localities of any species of economic importance are recorded on this card. In case no specimens are secured the "Acc. No." column says: "See notes" or "See letter." Thus this card forms a record of all material secured upon any species of economic importance, and by referring to it all accessions of that species can be found at a glance.

In connection with these distribution maps are used similar maps printed on thin tracing paper. On one of these is shown in different colors the approximate faunal areas of the State, on another the average rainfall for different sections or the rainfall for a given year, on another the average mean temperatures, etc. By superimposing one of these maps upon the distribution maps one can ascertain very quickly whether the insect is confined to any faunal area or is controlled by weather conditions, etc., so that it is only prevalent under certain conditions of rainfall, temperature, or altitude, etc.

The 5 by 8 card has been adopted, as it is a standard size and is the largest size that can be carried in a cover in the pocket. For field notes 5 by 8 heavy ledger paper, either with suitable heading or blank, and punched for duplex rod, is used. This is punched and carried in a "price book," 7¾ by 5, for sale by stationery dealers. A punch for this purpose is bought with the cover. This cover is made of flexible morocco and is the best note cover I have used, permitting the insertion or removal of any sheet without disarranging the rest of the contents. A stiff cover would not permit the use of 5 by 8 slips, as it could not be carried in an ordinary pocket. When these note slips are removed they are at once filed in their proper place without copying. Where it is desirable, diagrams of arrangement of plots, or schedules for recording data can be made and a number of copies made on these slips with a duplicator, either for field or laboratory use. I find this card large enough for almost all purposes of record, and a 5 by 7 photo print (the largest commonly used) can be placed on it. In many cases when a letter is received which is of such a nature that it contains the information to be recorded in as concise a way as if transcribed, it is folded once and one edge pasted on a card and filed that way. If large blanks or schedules are necessary for any purpose, they are folded so as to be slightly smaller than 5 by 8 and one corner attached to a card.

If now we were to undertake the study of sweet-potato insects, by turning to our food catalogue we have a list of all the species which we have observed injuring that plant, with the accession number or reference to notes or letter concerning each entry. If the sweet-potato weevil is then to be studied, we would turn to experiment No. 17, where would be found all the notes upon that species, with a record of all accessions of it and parasites and predacious enemies on the guide card. But where we wish to learn of some pest which has no experiment number, we would refer to the systematic file. Here under the proper family we would first find the double card bearing the distribution map and giving all the accession numbers and where the specimens are to be found in the collection, and after it all the notes on that species.

In keeping these records the office clerk enters any data stamped on the letter in the correspondence file and the food catalogue. He also makes all entries of the food catalogue and accession catalogue on the distribution map card, which gives the position of the specimen in the collection.

Two collections are being formed, one an ordinary systematic collection and the other an economic or biologic collection, arranged according to the food plants of the insects and the parts of the plant attacked. Both collections are kept on the Cornell block system, in glass cases, with the exception that cork carpet is used instead of the larger sizes of blocks, which are prone to warp. Where the insects are placed in the collection according to the food plant, it is manifestly impossible to find a specimen which may have a number of food plants, or if one does not happen to remember the food. To obviate this a system has been devised whereby the accession number indicates the place of the specimen in the collection. If the specimen is in the systematic collection, an "S" is placed after the number, as 324 S, and is at once easily found in its proper place. For indicating the place in the economic collection a fractional number is used in which the numerator is the accession serial number, and the denominator indicates its position in the collection the same as a shelf number in a library. Indeed, the same system is used. Each block is numbered the same as a book, according to the decimal system. For this I have used a modification of the outline furnished by the library of the United States Department of Agriculture for the classification of the books on agriculture. This brings all plants of a natural group under a given number and gives each individual plant a number indicating its position in the larger group. Also the part of the plant attacked is indicated by a number following a dash after the plant number. Thus $\frac{176\text{ L}}{36.26}$ would mean that the specimen is a larva (L), accession No. 176, and is to be found at 36.26 in the collection.

This later number is to be found on the front of the case in which the specimen is, or is included in the numbers of the first and last specimens in that case which are given on the front. The first digit of this number (3) indicates that the plant is a vegetable-garden vegetable; the second (6) that it is a solanaceous plant; the first digit after the decimal point that it is the tomato, whose number is 36.2. After this the 6 indicates that it is the fruit of the tomato which is injured. In like manner had this accession number a denominator 11.66 it would indicate that the insect affects the fruit (ear) of corn and is to be found at that point in the collection, or 15.16, cotton, etc. This number can be readily found by referring to the general decimal classification occupying but four sheets. This food number is given on the accession card at the lower corner on the back of the distribution map and on the food catalogue card. If the specimen is placed in the duplicate collection, for exchange or other disposal, it is marked "D" after the accession number, but rarely does this occur. Thus we can at once find any specimen, no matter in which collection or under what food. For the agricultural college I believe the building up of a good economic or biologic collection is of great importance. We wish the students to know the insects of a given food plant, which are much more readily studied when placed together. Also, if it is desirable to give a lecture before a farmers' meeting on the insects of some particular crop the cases are all ready to be carried to the lecture hall with the insects affecting that plant. Our cases are so constructed that strips can be quickly placed over the edges of the blocks without interfering with the specimens, and as the bent-necked bottles are wired to the blocks, the case, when ready, can be turned upside down and handled with impunity.

I might also briefly indicate one or two other card files in use. Clippings from newspapers are kept on manila slips 5 by 8 or 8 by 10 folded to 5 by 8, the clippings running the long way of the paper and leaving a space at the upper left-hand corner for writing the name of the species. They are then arranged systematically the same as the systematic file of notes, each species by itself, and chronologically under each species. Reports of county observers—a system for which we have modeled after that inaugurated by Doctor Felt in New York—are made on paper 8 by 10, which is folded 5 by 8, and are kept under printed guide cards by counties, alphabetically. Clippings concerning pests in that county or crop reports of that county are also kept here, together with a record of the correspondent literature and stationery furnished him, etc. Negatives are kept in card drawers with the rods removed, 3¼ by 4¼ in 3 by 5 drawers, 4 by 5 in drawers 4 by 6, and 5 by 7 in 5 by 8 drawers, as these drawers are made for cards and can be bought more cheaply than they can be built to order. Furthermore, they have a guide block which holds the negatives upright and solid no matter how many in the drawer. Each negative has a number in one corner and is kept in a folder on which all the data desired concerning it are recorded, and the negatives are given a serial number for each size. A print of each negative is kept with the notes in the experiment or systematic file, and the number of the negative and its size are given.

There are several considerations which commend such a general use of the card system to the entomologist. First, expansibility. Every one has experienced the inconvenience of having to keep notes on one species in half a dozen different places in the same book. The card system is capable of indefinite expansion. A second consideration is ease in filing and reference, for which I know of no method equal to the card system with the cards on edge so that they can be readily thumbed, and with guides to indicate the approximate position of material arranged alphabetically or numerically.

In my first experience in Maryland we had our note slips arranged in boxes like spool boxes, with the class or subject on the front. We found, however, that it took considerable time to open the box, hunt through it for a slip, as there was no way to indicate its position in the box, to replace the cover, etc. With the notes arranged on the card system with numerous guide cards, a given note can be quickly found and replaced without disarranging the file. Third is the consideration of divisibility. If one wishes information concerning the accesssions of a given species, for instance, he can remove these cards from the file and have them before him without the necessity of hunting through a book and copying off each item. Or in working up a report from notes, it is much more easily done by having all the notes on a uniform size of paper, which can be sorted according to different subjects or phases of the work and written up accordingly, without having to bother with a large volume or several notebooks, the bulk of which is on other subjects than the one in hand. Again, where more than one man is in an office it is a decided advantage to be able to remove certain notes from the file without interfering with the work of another, which would be necessary were they all in one book or in several books in which several species are dealt with. Fourth, compactness is a decided advantage along the same line. In the systematic file are to be found all the notes of a given species, genus, or family, all together, ready for use, with no necessity of looking to an index and hunting them up separately. A fifth point of the greatest importance is that no copying of field notes is necessary. Where one has ample time or clerical help this may not be an advantage, but few men have time to recopy notes made in the field, and where it is necessary they alone can do it. With the note slips they are filed just as written in the field, and if written intelligibly will always be so.

How many a note written on the back of an envelope has been lost. How often has a man gone to a new place and found that though his predecessor has done years of faithful and valuable work, there are no records from which he can gain any knowledge of any of that work, except such as may have been published, or upon which he can build future work. One of the greatest difficulties under which our agricultural colleges and experiment stations are laboring in many States is the frequent change of men. For the present there seems to be no way of avoiding this. But it does seem to the writer that the work of its employee belongs to the station, college, or State, and should not be confined to the entomologist's head and carried off with him when he retires, but should be placed in writing in such intelligible shape that a successor can pick up the work and carry it for-ward with some degree of continuity. A proper note system, whether like the above or some other, should greatly obviate this. The trouble lies in a lack of system.

Many large business houses are now discarding their ledgers and keeping their accounts and other data on cards, saving money by time saved with the greater convenience of such a system. Furthermore, it enables facts and information to be obtained readily, which, by the use of books, required so much work that they were rarely ascertained. By following some such methods the usefulness and permanent value of our entomological work can undoubtedly be greatly increased.

In discussing this paper, Mr. Felt stated that he had adopted a card system for accessions to the New York State collections, and that he believed any system would prove impracticable unless it was as simple as possible, in order to save time and clerical work. He has adopted a topical arrangement for all easily classified replies to letters, minuting upon the original the topic under which the copy is filed. All communications are filed alphabetically under name of writer or institution, and if the reply is in the topical file its subject can easily be ascertained by reference to the original communication. This system avoids the necessity of employing index cards and the labor incident thereto, and in many instances a reference, either to the alphabetic or topical file, would be sufficient, and only occasionally would it be necessary to consult both. He did not think that a collection could be catalogued satisfactorily.

Mr. Webster remarked that note keeping should be simply a means to attain a desired end, and that each person ought to select a system that best met his wants. The simpler methods should always be selected for the reason that an elaborate system will, in the course of time, become cumbersome and require so much clerical work that for most entomologists it would be wholly impracticable.

Mr. Fletcher observed that card catalogues were being used more than ever in all lines of work and that the entomologist should adopt such improvements as would be of assistance in his work and save time.

The following paper was then presented:

NOTES ON THE TREATMENT OF NURSERY BUDS.

By A. F. Burgess, *Columbus, Ohio.*

A common method of treating buds or grafts that are to be used by nurserymen has been to immerse them in whale oil soap mixture or to fumigate them with hydrocyanic-acid gas before planting in order to prevent the possible introduction of the San Jose scale. Some growers fearing that the action of the soap on the buds would prevent growth and result in their failure to properly develop have followed the practice of allowing the bud sticks to remain in the mixture for a short time, and on taking them out of washing them with water in order to remove as much as possible of the caustic material remaining, with a view to preventing injury. Others have tried fumigation in a limited way, but realizing that should this process cause injury, especially to the more tender varieties of trees, such as the peach, it would mean great financial loss, have been slow to adopt this measure.

In order to test the value of these treatments a set of experiments was begun at Painesville, Ohio, in August, 1902, in cooperation with Mr. W. B. Cole, of that place. The objects in view were to ascertain the effect of the treatments on the development of the buds and also to determine their action on living San Jose scale.

An excellent set of experiments on the fumigation of apple, pear, cherry, peach, and plum buds was conducted by Messrs. Lowe and Parrott in New York and was published in December, 1901 (Bulletin No. 202, N. Y. Agr. Expt. Station), but check trees were used to test the effect of the gas upon the scale, and the latter were fumigated in December and early in June.

In the experiment at Painesville peach trees were selected, as they were the most tender fruit trees available, and badly infested fruit from apple trees was fumigated or treated with the soap mixture at the same time and in the same manner as the buds.

FUMIGATION OF PEACH BUDS.

On August 28 three lots of Kalamazoo peach bud sticks were tied in bundles and placed in a gas-tight box, which was double boarded, with a double thickness of building paper between, and exposed to the action of hydrocyanic-acid gas for forty minutes. The cyanide used was of 98 per cent purity and the sulphuric acid was of the commercial grade. The following charges were used for each 100 cubic feet of space:

Lot 1: 1 ounce cyanide, 1 fluid ounce acid, 3 fluid ounces water.

Lot 2: Three-fourths ounce cyanide, three-fourths fluid ounce acid, 2¼ fluid ounces water.

Lot 3: One-half ounce cyanide, one-half fluid ounce acid, 1½ fluid ounces water.

Several apples badly infested with San Jose scale were fumigated with each lot.

TREATMENT OF PEACH BUDS.

On the same date two lots of Wheeler's Late bud sticks were immersed in whale oil soap mixture. Good's No. 3 whale-oil soap was used at the rate of 2 pounds and 1 pound to each gallon of water. The sticks were removed after remaining fifteen minutes and, with the exception of a few that were selected from each lot, were placed under a faucet and thoroughly washed with running water. Those that were selected were not washed, but the soap mixture was allowed to dry in order to determine whether any injury would result to the vitality of the buds. Scale-infested apples were treated in a similar manner.

The seedlings were budded with the fumigated and treated buds by experienced workmen on the afternoon of the treatment and the morning following. The experimental trees were located in the center of a large peach block, the rows extending from east to west.

Check trees were budded with untreated buds at the west end of the rows, while those buds that were treated with the soap mixture without washing were at the opposite end.

Mr. Cole writes, under the date of September 2, 1902: "The seedlings run a little under size and the weather rather dry, for our soil, so that the stocks did not work quite as freely as usual. Morning of September 1 we had a soaking rain."

The trees were examined July 23, 1903, and the following tables give the results of the treatment:

Record of Kalamazoo peach buds fumigated with hydrocyanic-acid gas.

Lot No.	Formula.	Number of trees budded.	Number of buds set.	Percentage of buds set.
1	1 ounce cyanide	938	731	78
	Check	105	79	75
2	¾ ounce cyanide	1,085	749	69
3	½ ounce cyanide	1,050	705	67

Record of Wheeler's Late peach buds treated with whale oil soap mixtures.

Formula.	Further treatment.	Number of trees budded.	Number of buds set.	Percentage of buds set.
2 pounds per gallon	No	69	55	80
Do	Washed	964	652	68
Check		86	58	67
1 pound per gallon	No	68	52	76
Do	Washed	961	559	67
Check		86	48	56

It will be noted that the peach buds were not injured by fumigation or treatment with the soap. The fact that a greater percentage of the buds failed at the west end of the rows is due to other causes, such as the character of the ground and climatic conditions.

THE EFFECT OF THESE TREATMENTS ON THE SAN JOSE SCALE.

The fruit used in the tests was badly infested with the scale and in most cases many young lice were present. After the fumigation or treatment it was placed in paper sacks, which were labeled and removed to the office at Columbus, where the following records were made:

FUMIGATION.

Test No. 1:

August 28, 1902. Fumigated four apples, using 1 ounce cyanide; treatment similar to that of the buds in lot 1.

August 31, 1902. No living young or old scales present.

October 15, 1902. No young have developed. Old scales dead.

Test No. 2:

August 28, 1902. Fumigated three apples, using three-fourths ounce cyanide; treatment similar to that of the buds in lot 2.

August 31, 1902. No living young or old scales present.

October 15, 1902. No young scales have developed. Old scales dead.

Test No. 3:

August 28, 1903. Fumigated three apples, using one-half ounce cyanide; treatment similar to that of the buds in lot 3.

August 31, 1903. No living young present. On two apples some of the old females are apparently alive.

September 6, 1903. No young found. Old scales apparently dead.

October 15, 1903. No young have developed. Old scales dead.

The effect of the gas on the scales was fatal in each case. No living insects were noted in three days after treatment except in test No. 3, where the smallest amount of cyanide was used, and they perished without giving birth to young.

DIPPING IN WHALE OIL SOAP MIXTURE.

In the following tests the apples were placed in a coarse sack and immersed in the soap mixture for fifteen minutes.

Test No. 4:

August 28, 1902. Dipped three apples in whale oil soap mixture; 2 pounds of soap to each gallon of water.

August 31, 1902. No living young or old scales observed; scales are dark in color.

September 6, 1902. A few young scales and lice present.

September 15, 1902. Two apples very slightly infested; one not infested.

October 15, 1902. Two apples very slightly infested; one not infested.

Test No. 5:

August 28, 1902. Dipped three apples in whale oil soap mixture; 2 pounds of soap to each gallon of water. After removal they were washed with water.

August 31, 1902. Scales are bright in color; young lice present on two apples.

September 6, 1902. Most of the old scales are dead; many young crawling. Well-developed females appear to be more easily killed than immature ones.

September 15, 1902. Many young scales present.

October 15, 1902. Plenty of live scales in all stages.

Test No. 6:

August 28, 1902. Dipped three apples in whale oil soap mixture; 1 pound of soap to each gallon of water.

August 31, 1902. Lice crawling on two of the apples.

September 6, 1902. Many mature females dead; lice and young scales present on all apples.

October 15, 1902. Plenty of live scales in all stages.

Test No. 7:

August 28, 1902. Dipped three apples in whale oil soap mixture; 1 pound of soap to each gallon of water. After removal they were washed with water.

August 31, 1902. Plenty of young on all apples.

September 6, 1902. Plenty of young on all apples; few old females dead.

September 15, 1902. All apples thoroughly infested.

Test No. 8:

August 28, 1902. Check lot of infested apples. Scales breeding profusely

September 6, 1902. All apples thoroughly infested.

September 15, 1902. All apples thoroughly infested; badly rotted.

In the above tests with whale oil soap mixture it will be noted that many of the mature females were killed, but in all cases where the fruit was washed after treatment a large number of young developed. When used at the rate of 1 pound to each gallon of water and treated as in test No. 7 few of the scales were killed. The most successful treatment was in test No. 4, where 2 pounds of soap was used to each gallon of water, no washing being given the fruit, but even in this case one or more scales survived, as two of the three apples were very slightly infested at the close of the experiment. It is a difficult matter to reach every scale even by this method, as some time is required for the liquid to penetrate those that are hidden beneath the calyx lobes of the apple, which seems to be a favorite place for the young lice to settle.

A comparison of the method of dipping the buds and that of fumigation shows that the latter is more effective and leaves them in better condition for use. The cost of either measure is so small that it is scarcely worth considering when the benefits to be derived are taken into account. A little more time is required for fumigation, but the results are certain.

Buds may be injured by exposing them to the action of the gas for too long a time. Mr. Cole writes me that he has injured well-matured plum buds this season by allowing them to remain exposed to the gas for three or four hours. In all cases of injury the bark on the immature parts of the bud sticks was discolored. He further states, "I used cyanide, 1 ounce to 100 cubic feet, fumigated in the box we made last year. We used the buds that showed no discoloration, and where buds have been exposed but forty minutes my men have made no complaint of injury."

SUMMARY.

The results of these experiments show that the fumigation of bud sticks, using from three-fourths to 1 ounce of cyanide to each 100 cubic feet of space and exposing for forty minutes, is effective in destroying the San Jose scale and is not injurious to the buds. The soap treatment, when used as in the experiments detailed above, is not wholly effective, and if the sticks are washed after treatment it is of little value as far as killing the scale is concerned.

Owing to the practice of nurserymen of obtaining their buds, cuttings, and grafts from many different sources and to the fact that several recent cases of nursery infestation can be traced directly to the use of infested buds, all growers should be urged to fumigate all stock of this character before it is used in the nursery.

Mr. Lochhead said that the question had been raised in Ontario as to the relative merits of fumigating bud sticks or dipping them in whale oil soap mixture, but as the law in that province required fumigation he had not allowed the dipping method to be practiced as a substitute. The standard formula was used in Ontario for fumigating nursery stock and had proved very satisfactory, viz, 1 ounce of potassium cyanide (98 per cent pure), 1 fluid ounce commercial sulphuric acid, and 3 fluid ounces of water to each 100 cubic feet of space, with an exposure of about forty-five minutes.

Mr. Gillette mentioned the fact that the fumigation of all nursery stock entering Colorado might be required in the future, and queried as to the best formula to use.

Mr. Burgess stated that the formula recommended by the Division of Entomology, at Washington, and used in Canada, mentioned by Mr. Lochhead, had been used in Ohio with good results. He further stated that he had presented a paper concerning this matter at the last annual meeting of the horticultural inspectors at Washington, D. C., in November, 1903, and that the matter of a uniform formula had been discussed. The one decided upon for general use differed slightly from the one already mentioned, the amount of sulphuric acid and of water being increased 1 ounce each for every 100 cubic feet of space. Unfortunately, the length of time for exposing the stock was not mentioned, and later it was ascertained that the practice of those who already used this formula varied from an exposure of thirty to sixty minutes. It would seem desirable to have a definite length of time for exposure before adopting a uniform formula.

Mr. Fletcher said that all nursery stock imported into Canada was fumigated by government officials, and that the results had been very satisfactory. No living scales had ever been found after the stock had been fumigated, and no trees had been known to be injured by this process. In case the trees were carelessly handled, or allowed to remain with the roots exposed, they were sometimes damaged, but this could not be charged to the fumigation. No bad results had been reported where three times the normal strength of gas had been used. The local nurseries in Canada are required to fumigate their stock at the expense of the owner; the government pays the expense of fumigating at the ports of entry.

Mr. Martin queried as to the value of lye as an insecticide for treating bud sticks.

Mr. Gillette expressed the opinion that this material was of little value for the destruction of insects.

Mr. Martin stated that an orchardist in Tennessee had used it and reported good results. Mr. Martin had not been able to make an examination of the orchard, but the owner had inspected the trees in May or June and failed to find many live insects.

Mr. Burgess said that several peach trees had been treated experimentally with red seal lye in the spring of 1903 in Ohio; 7 and 15 pounds of this material were used to each 50 gallons of water. The trees became so badly infested by the middle of the following September that they were destroyed by the owner. Several parties had used the same material on an extensive scale last spring, and it had proved worthless for destroying the San Jose scale.

The following paper was then read:

THE RELATION OF THE SYSTEMATIST TO THE ECONOMIC ENTOMOLOGIST.

By F. M. WEBSTER, *Urbana, Ill.*

[Withdrawn for publication elsewhere.]

A general discussion of this paper followed.

Mr. Osborn considered that it is the duty of the systematist not only to describe species but to determine their relation to other known species and genera. He believed that described species should be considered as something that exists in nature, and that such as are not known from types, or can not be found in nature, should be classed as lost species. Several instances were cited of insects that are now described and listed, but which are not represented in collections, and have never since the time that they were described been found in nature.

Mr. French stated that species were often described from a single specimen, and that he had in his collection possibly the only specimen known of *Apantesis shastaensis*. Whether this is an aberrant form of some known species or a species that may still be found in the Shasta Mountains is a question for future investigation.

Mr. Hine suggested that by continual study the systematist was able to detect minute characters easily, whereas a person unfamiliar with a particular group would fail to observe them.

Mr. Summers remarked that although the systematist lays the foundation for economic work, so far as accurately determining the species is concerned he is not dependent upon the economic worker, and therefore very often fails entirely to consider his needs. During the progress of systematic work, there must necessarily be many changes in the nomenclature of the older species, and the economic entomologist must accept these changes after time has proven them to have been well considered.

Mr. Webster considered that it was the upheavals, the sudden and frequent changes, that cause the trouble for the economic worker. The systematist can not properly carry on his investigations without a knowledge of the relation of one species to another, and such work comes within the province of the morphologist. Many species can not be properly and accurately determined without a knowledge of the larval stages, so that the life history work is very important and should not be overlooked.

Mr. Fletcher believed that the best accepted check lists should be used in toto by everyone until better ones took their places, and that the good work done by the systematist would be accepted by the economic worker in time as check lists became more and more perfect. He cited the work of the ornithologists, who, with the small number of species they had to consider, were able to accept a single name without citing an author. This was impossible with the vastly larger number of species of insects. Differences in names did not matter so much if writers would always cite the authors when using a scientific name.

Mr. Cooley next presented a paper, which is as follows:

NOTES ON A GRASSHOPPER OUTBREAK IN MONTANA.

By R. A. Cooley, *Bozeman, Mont.*

During the past three years grasshoppers and dry weather have been responsible for extensive losses in Montana. These losses have fallen, for the most part, on those citizens interested in the grazing of cattle, sheep, and horses on the fenced and open ranges. Less extensive, though serious, damage has been done in the agricultural valleys, where grain and alfalfa were in some cases completely destroyed. The trouble began three years ago in two localities fully 150 miles apart—one in Carbon County, the other in Rosebud County. In these localities the insects have been steadily multiplying during the three years, and each locality has increased year by year until, during the past season (1903), the advancing border lines met in the vicinity of Billings, thus making one infested tract fully 150 miles in length and of varying width.

The affected region may be roughly outlined by stating that it embraces all that part of Montana drained by the Yellowstone River between Miles City and Bigtimber, including not only the valley of the Yellowstone, but the valleys of the side streams that come in from the south and most of the cross countries between the tributaries.

So completely has the grass of the range been taken in some parts of this region that the ranchers have been obliged to sell their stock at a sacrifice or remove it to distant ranges. Many thousands of animals have gone north and south, and are now being fed on ranges that previously were occupied by local stockmen. Farther west, on and across the divide between the Yellowstone River and the Gallatin Valley, the same species that are causing the destruction in the eastern part of the State have so increased in numbers that it is feared more or less damage will be done during the summer of 1904.

The grasshoppers should not be held responsible for all the loss that has been experienced in the grasshopper-ridden region. Coincidental with the appearance of these insects in unusual numbers has been a series of years in which the late snows and early rains have been much less than in previous years, and apart from any direct or indirect influence which the lack of these storms may have had on the grasshoppers or their natural enemies, the small amount of moisture has seriously interfered with the growth of the grass.

No one species of grasshopper is alone the cause of the devastation nor are the principal destroyers the same on the range as in the irrigated valleys. *Aulocara elliotti* Thom. was the most abundant species on the hillsides, with *Melanoplus atlanis* Riley second and *Camnula pellucida* Scudd. third, but more local in its distribution. Besides these were many other species, which varied greatly in abundance in different localities, dependent on a variety of causes. The first two mentioned species (*Aulocara elliotti* and *Melanoplus atlanis*) together made upon an average of about 60 per cent of all the grasshoppers on the hillsides.

The principal species that fed in the alfalfa fields is *Melanoplus bivittatus* Say. With it was found also *M. atlanis* and various others, while in the grain, which usually is grown on higher ground, were found *M. atlanis* and *A. elliotti* in about equal numbers.

Though the entire affected region is within what has been known as the permanent breeding ground of the Rocky Mountain migratory locust, *Melanoplus spretus* Uhl., not one specimen of this species was taken during the season, nor has the writer been able to capture a specimen during the five years that he has collected in all parts of Montana. What has become of *Melanoplus spretus?*

The writer has been unable to be of any practical assistance to the citizens of his State who have suffered loss on account of grasshoppers. The use of arsenical poison or kerosene pans is absolutely out of the question, except in the cultivated fields of the valleys, and plowing or harrowing would be inadequate to a degree that provokes a laugh.

The use of contagious diseases seemed to be the only artificial means that offered any hope of returns. Accordingly, through the kindness of Prof. C. P. Gillette, a culture tube of the South African fungus disease was secured and from it culture tubes were made and sent out to persons requesting them. Nearly 300 tubes were distributed, but, so far as we are now informed, absolutely no good was accomplished. Besides these practical field tests, various other trials were made in the laboratory in cages constructed for the purpose, but no favorable results were secured.

While realizing that an experimenter should not have convictions before he has performed his experiments, the writer must confess that very little was expected from the use of the fungus. The test was undertaken since it offered the only hope of relief, for we felt that, since we have authentic statements to the effect that a greater or less measure of success has been secured in other parts of the world, we can be successful in the United States if we can secure the same organism and duplicate the conditions that obtained in those successful tests.

Remarks concerning the damage caused by grasshoppers were made by Mr. Fletcher and Mr. Gillette. Mr. Cooley stated that the area devastated in Montana was so large that the problem of control would approach that of covering an acreage equal to the entire State of Massachusetts. The fungus disease received from South Africa had proved of little value, and Mr. Gillette stated that his experience with it had been the same in Colorado.

MORNING SESSION, WEDNESDAY, DECEMBER 30, 1903—9 A. M.

The meeting was called to order by Doctor Fletcher, and the following paper was presented:

OBSERVATIONS ON THE LIFE HISTORY OF LIBURNIA CAMPESTRIS, WITH NOTES ON A HYMENOPTEROUS PARASITE INFESTING IT.

By Otto H. Swezey, *Columbus, Ohio.*

In the family Fulgoridæ there are very few species whose life history has been completely worked out. For the most of the species very little is known of their egg-laying and the younger stages. During the past season I have been able to make some interesting observations, including a fairly complete tracing of the life history of a few species.

Liburnia campestris is our most common species in grass lands throughout the eastern and central part of the United States. It is one of the species showing dimorphism, some individuals having elytra somewhat shorter than the abdomen (brachypterous), while others have the elytra extending for about one-third of their length beyond the abdomen (macropterous).

In the autumn of 1902, at Columbus, Ohio, nymphs of some species were taken in quite large numbers, whose identity at the time was impossible to determine further than that they belonged to the subfamily Delphacinæ, as evidenced by the movable spur at the apex of the tibia. It was thought that they might be the same species which Mr. Van Duzee has reported having taken in New York State in the immature form in the autumn and which he thought might prove to be *Achorotile albosignata*, a European species. A character tending to give one this opinion is that the nymphs have two median carinæ on the face.

In the spring of 1903 this nymph was quite abundant on the campus of Ohio State University. By caging some of them they transformed to the adult stage, and it was proved that they were *Liburnia campestris*. In the final molt the two facial carinæ of the nymph have fused into one median one, forked at the vertex. I am inclined to the opinion that this character of two median facial carinæ will be found to hold for the nymphs of the other species of Liburnia, when they have been discovered.

Nymphs of *L. campestris* were very abundant during the middle of March, and by the last week of the month adults began to appear in places where nymphs had been taken in abundance. April 11 I witnessed the transformation of three specimens from nymph to adult; at this time the adults were becoming quite abundant, increasing from that time on while the nymphs were decreasing, till by the last week in April none were taken.

May 1 a breeding jar was prepared with growing blue grass, and a dozen each of males and females placed therein. Egg deposition was never observed, but it must have occurred soon, for larvæ were noticed in abundance May 17, or in about two weeks. Examinations of the grass in the jar showed the manner in which eggs were deposited. The sheath of a grass leaf is punctured at one angle of the stem, and eggs are placed inside the substance of the leaf sheath, about four to eight in a row, up and down. Often several of these groups occur above one another in the same leaf sheath. The eggs slant downward from the place of insertion. The head end of the larva is uppermost, so that it may readily crawl out when hatched. After learning the place of deposition of eggs, search was made in the field and many grass stems found containing eggs, which were in all cases in the leaf sheath, as above described, and at a distance of 2 to 4 inches from the ground. Not a large number of eggs are deposited by each individual. By dissecting and counting eggs of several females, the number contained varied from 17 to 30. The period of egg-deposition undoubtedly extends throughout May, as the time of maturing of the hibernating nymphs extended over a period of about four weeks, beginning the latter part of March.

The young nymphs in the breeding jar reached their full growth in about six weeks, or the last week in June. At this time the observations were interrupted, so that the exact length of time to reach maturity was not ascertained, but freshly transformed adults were taken quite plentifully the first week in July. All through July and August adults as well as nymphs of all sizes were very abundant. My observations were not conclusive as to whether there was an additional brood in the summer; but two broods are proven. To recapitulate: We have nymphs hibernating, reaching adult stage latter part of March to middle of April; eggs deposited about April 15 to June 1, nymphs reaching maturity throughout July. These adults probably produce the eggs for the brood of nymphs which hibernate, but I am not certain but what a third brood intervenes. I did not ascertain the time of egg-deposition for the hibernating brood of nymphs.

Details in the life history of *Liburnia lutulenta* are virtually the same as for *L. campestris*. The two species are often taken in the same locality, but *lutulenta* is more apt to be found in lower ground. The nymphs of the two species are very similar in color in the hibernating broods, those of *campestris* being dull light gray in general color, while those of *lutulenta* are darker; markings are similar, but *lutulenta* has a conspicuously defined lighter area on the tergum of first and second abdominal segments. The summer nymphs of *campestris* are lighter in color, often almost white, and usually of varying shades of yellow.

These two are the most abundant species of Fulgorids living in grass lands, so far as I have observed, and they may come to be of some economic importance should they suddenly increase in large numbers; but so far as I have noticed, their injury to grass by sucking the sap from the stems and leaves is very small compared to the injury resulting from the feeding of various species of Jassids, some of which occur in great numbers.

If these two Fulgorids should become so abundant as to be doing appreciable damage, they might be kept in check by close and frequent mowing of the grass during the period of egg-deposition. This would cut off the grass containing most of the eggs, and it was found that the eggs dried up and failed to hatch if the grass containing them was allowed to dry.

A check to their increase to injurious numbers is a hymenopterous parasite, *Gonatopus bicolor*, which is quite common upon both species. Some notes in regard to the habits of this parasite were published in the June number of the Ohio Naturalist, 1903. The larva of the parasite lives in a sack protruding from between the segments on the dorsal side of the abdomen of host. Nymphs of *Liburnia lutulenta* of the brood which hibernated were found infested with these parasites, only one parasite to a host. Some of these were reared to maturity and the parasite identified in the adult stage. When the parasitic larva gets its growth it escapes from the sack and spins a tiny white cocoon in the groove of a grass blade or some other suitable place. The growth of the larva so exhausts the host that it results in its death about the time the full growth of the parasite has been attained. The adults come forth from the cocoons in about three or four weeks. In all cases under observation the females thus obtained were *Gonatopus bicolor*, while all the males were what has been described as *Labeo longitarsis*. Parasitized nymphs of *Liburnia lutulenta* and *Liburnia campestris* were taken at various times during the summer months, and rearing the parasites they always came out as above. This confirms the opinion expressed in the published notes above referred to that *Gonatopus bicolor* and *Labeo longitarsis* are the same species. It is probably on account of this sexual dimorphism and the lack of knowledge of their life history that the males and females of this species have been described as different species.

When the above-mentioned notes on *Gonatopus bicolor* were published in the Ohio Naturalist I had reared it only from *Liburnia lutulenta*. At the time little thought was given to the possibility of the parasite coming to have any economic importance. By some means the attention of the entomologists of Hawaii was called to these published notes, and Mr. Albert Koebele was sent to Columbus, Ohio, to investigate the matter and, if possible and if thought feasible, to undertake the introduction of these parasites into Hawaii to prey upon a Fulgorid, which is a pest upon the sugar cane. Probably many of you are aware already of the work done at Columbus during the summer by Mr. Koebele. He collected parasitized nymphs of *Liburnia lutulenta* and other species of Fulgorids and Jassids as well, reared them till the parasites attained their growth and spun cocoons, in which condition they were sent to Hawaii. Mr. Koebele was very successful in this collecting and rearing of parasites. Several thousand specimens were sent to Hawaii during the latter part of summer and early fall. These were probably of more than one species, since they were reared from a variety of species of hosts. At present it is with considerable interest that we await reports from Hawaii in regard to whether the parasites accepted the new host and new situation, and the probability of their being a check to the ravages of the sugar-cane Fulgorid.

Mr. Hine stated that he had watched the progress of this work closely and thought the results very important; also, that Mr. Koebele was hopeful that the insects sent to the Hawaiian Islands would survive and prove beneficial. Adults have already been reared from the cocoons sent to Hawaii by Mr. Koebele.

A paper was next presented entitled—

SOME DISTRIBUTION NOTES.

By F. M. Webster, *Urbana, Ill.*

In Volume IX of the Journal of the New York Entomological Society I gave the distribution of *Myochrous denticollis* in the United States, so far as I was able at that time. Quite recently Prof. W. S.

Blatchley, State geologist of Indiana, who has collected Coleoptera rather extensively in that State, sent me the following list of counties in which he had collected the beetle, and which are as follows: Posey, Floyd, Orange, Vigo, and Laporte. Thus this beetle is known to occur throughout the entire length of Indiana. As it may become a serious enemy to growing corn, this information has a certain practical value. In my paper just referred to I also gave the distribution of *Myochrous squamosus*, as far as it was then possible. At that time I had a rather vague report of its having been found in Kentucky, but as this was far out of its known range of distribution I withheld the information until such time as I could either verify it or be more prepared to show that it was an error. I find, however, that one of Dr. Forbes's assistants has taken it in Central Illinois on weeds and corn, and the Kentucky locality does not now appear at all doubtful.

Some ten years ago the late Mr. Bolter, of Chicago, wrote me that about twenty-five years before he had found the asparagus beetle (*Crioceris asparagi*) as far as 40 miles to the west of that city, but had ~~never~~ observed it since that time; also that Mr. B. D. Walsh had given him specimens taken about Rock Island, Ill. The species has remained unknown, so far as I am able to learn, in Illinois since that time. Last year, 1902, and again this year, 1903, two of Dr. Forbes's assistants have found it quite plentifully in some of the northwestern suburbs of Chicago.[a] During the past summer I searched carefully for it about Rock Island, but failed to find it there. It is certainly interesting that it should have continued to exist about Chicago during these thirty-five years without spreading, while in Ohio and Ontario its diffusion to the westward is sufficiently marked to attract considerable attention. When this westward tide of migration reaches Illinois, as now seems every way probable, it will be of much importance to observe if it stops here or continues its westward march across the State, leaving the old colony about Chicago behind.

I may add that the harlequin cabbage bug (*Murgantia histrionica*) is represented in the Bolter collection by a specimen taken about Chicago, while it bred in Urbana in 1896, the same year that it pushed its way north in Ohio, breeding on rape at Wooster and being found at Hinkley, about 25 miles from the south shore of Lake Erie.

Mr. Gillette reported the presence of the harlequin cabbage bug in Colorado and said that *Diabrotica vittata* is spreading in the State, a few specimens having been taken at Fort Collins.

Mr. Fletcher stated that in Ontario the asparagus beetles were spreading east and west; also that both species were present, but that the injury had not been so severe as was anticipated.

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[a] In one of these localities an asparagus grower stated that the species had been present in that vicinity about twenty-five years before the time of writing.—E. S. G. T.

Mr. Sanderson reported that *Crioceris asparagi* had, in his experience, injured new beds of asparagus.

Mr. Green reported that he had found this species 40 miles west of Chicago.

Mr. Gillette next read a paper entitled—

WHAT CREDIT SHALL WE GIVE?

By C. P. Gillette, *Fort Collins, Colo.*

What credits shall we give to those who assist in carrying on our investigations? Probably no one has been long engaged in scientific research who has not heard of other workers who do not give fair credit to those who assist them. Undoubtedly there have been occasions where such complaints were well founded, but it is also probable that heads of departments have often been seriously misrepresented by ambitious assistants who overestimate the importance of their work and are too eager to see their names in print.

I am of the opinion that there is much lack of uniformity also on the part of scientific workers in the matter of giving credit. Probably it is impossible to lay down definitely rules to be closely followed in all cases, but it seems to the writer that there are certain general principles that could be agreed upon and that would lead to af airly uniform practice if followed out. Perhaps it is not discreet to present a topic that is likely to meet with so wide a difference of opinion as this one, but I have no complaints to be adjusted, and I have frequently heard of the unfairness of other scientific workers in giving too little credit, and I believe there is no body of men more likely to agree upon a broad and just plan for the giving of credits than this body of economic entomologists. I am bold, therefore, to present this brief paper in the hope that it may help to bring about a better understanding and more universal good feeling between scientific workers and their assistants, and I wish it thoroughly understood that the paper is not written in criticism of anyone, and I have no one in mind as an offender in these matters.

What credit should be given in a particular case depends upon many conditions. In the first place I should make two very distinct classes of the assistance that might be rendered, viz, unskilled and skilled. Whether the man who plows the ground and plants the seed and cultivates the crop deserves any special credit or not when the final results of the experiment are published to the world, depends upon whether or not he has, on account of special training and ability, added materially to the value of the results obtained.

First, let us consider what credits should, in justice, be given to unskilled help. Here again we shall have to make a twofold division and consider whether the work is being done under the direction and supervision of another or whether it is independent and original on the part of him who performs it. When the work has been planned and directed by the head of a department and carried out by an unskilled assistant there is no reason why any credit should be given unless such work is unpaid and voluntary. If such a helper, however, has shown unusual fidelity and ability, favorable mention might not be out of place. If the help has been voluntary and unpaid, the person should be given credit for his service if of much importance. His statements and observations, if quite valuable, may be quoted directly as coming from him. An orchardist, for example, puts bands upon all his apple trees and examines them once a week throughout the summer and fall at the request of the entomologist of an experiment station, and keeps a complete record of the worms found at the different dates and gives the results to the entomologist. Full credit should be given for the data furnished if they are used. On the other hand, if a man had been hired to do the same piece of work and furnish the data obtained he would have no claim for credit in a publication of the results, though to give credit would not be out of place and might be necessary as a matter of defense on the part of the entomologist. However, it is not from this class of help that we are most likely to hear complaints of too little credit, but from the other class that I have designated as "skilled."

Before going further let me mention the different ways in which credit may be given. There may be favorable mention (a brief statement giving credit), a direct quotation, joint authorship in publication, or independent publication on the part of the assistant.

In determining the credit due to a skilled assistant we shall also have to know, first of all, whether the work was planned by the head of the department, or whether it was independent and original work on the part of the assistant. If the work was planned quite fully by the head of the department and carried out by an assistant whose name is published with the paper, the writer would take the position that such assistant has no claim upon the head of the department for any further mention. At the same time, if the work were such as to reflect special credit upon the assistant, the author would doubtless be glad to make mention of the fact, and there would be nothing improper in his doing so.

On the other hand, if the work were done by a volunteer and unpaid helper, he ought always to be given credit for his part in the work, either by favorable mention or by direct quotations from his statements. For example, we will suppose experiments are being carried on to determine the life history of the codling moth and an assistant is given full directions and is set to work keeping full records upon wormy apples and numbers of worms appearing daily under bands upon a certain number of trees throughout the season; the work is faithfully done and reported upon. The one directing the experiment examines the results, rejects certain records that show strong evidence of being abnormal or unusual, decides that certain observations will have to be repeated another year, and finally tabulates the figures and draws conclusions which he is willing to publish. The experiment is his, and he alone is responsible for the results. If he wishes to tell the world what part an assistant had to do in the work, he can do so, but the assistant has no just complaint if his name does not appear in the published results, unless the value of the results is due in considerable part to the originality or unusual qualifications of the assistant.

On the other hand, if the assistant in the progress of the work shows unusual skill and makes original observations of an important kind that were not anticipated in the planning of the experiment, and are not the natural and logical result of carrying out the work as planned, it is but just that he should have credit for it. What that credit should be will be determined by the importance or degree of originality of the observations or experiments that have been made. For example, an assistant is sent to keep records of worms taking refuge under bands of certain apple trees during the summer. One tree, apparently comparable with the others, gives a very much smaller record of worms. The assistant, upon going to the orchard just at the break of day one morning, finds ants capturing the worms upon this tree and carrying them away, and then notices that the nest from which these ants came is located near this tree. The observation is an independent one, not anticipated in the planning of the experiment, and if used the assistant should be given credit, and a mere mention of the fact, giving the assistant's name, is all that is needed. Or an assistant is sent into the field to search for the native food plants of an insect that is native to the locality, and which has turned its attention to cultivated crops. The assistant is told what family of plants the insect is most likely to be found upon. He goes and returns in a few hours with the desired information. It is likely that his success is due largely to his knowledge of botany and a knowledge as to what situations such plants would be found in. While such a case may not be one that would demand special credit being given, it is the opinion of the writer that it would be advisable to give the assistant credit for his observation in way of a mere statement of the fact. If in either of the above cases the assistant were asked to make extensive observations his work might be of sufficient importance to quote him directly or to offer him joint authorship in a paper upon one of the insects treated.

If a skilled assistant is asked to pursue a line of work for which he has shown special ability, the work being directed only partially or not at all by the head of a department, such work may be the basis for a joint publication or for independent publication, as seems advisable and just by the head of the department. In any case, the fact must not be lost sight of that the head of a department is responsible for the publications of his department. If an assistant publishes a paper that is a discredit to himself, it is also a discredit to the head of the department in which he works. On the other hand, if an assistant publishes a paper that is a credit to himself, that credit is reflected also upon the head of the department. It therefore seems to the writer to be but fair to an assistant, if he has carried on a piece of work of his own planning and direction and writes a valuable paper upon the same, he ought to be allowed to publish under his own signature. If the work has been largely planned and directed by his superior, the assistant has no reason to expect anything more than joint authorship, although the actual work in carrying on the experiment and making the observations may be entirely his.

When the work of an assistant is purely perfunctory and done under direction, the writer sees no special reason why credit should be given in ordinary cases.

As stated in the outset, the whole matter of giving credit for assistance can not be determined by hard and fast rules. I have attempted to give what seem to me to be the broad, general principles which should regulate such matters. A definite understanding between the head of a department and an assistant when the latter begins work would usually do away with dissatisfaction in these matters.

Originality and independent work upon the part of an assistant are the qualities especially worthy of recognition, and in their absence there is very little that an assistant could reasonably ask in the way of special credits in the publications of the one who directed the work. At the same time I should prefer to give credit where there is little reason for doing so than to appear to be giving an assistant less credit than his work deserves.

There are several phases of this subject that should be treated more at length. I have only attempted to write enough to get the subject well before the Association, and there may be those present who have views widely at variance with those I have expressed. I shall be glad to have the subject thoroughly discussed, in the hope that we may agree upon general plans for giving credits to those who assist us in our various lines of work.

Mr. Fletcher heartily agreed with the sentiments expressed in the paper. He thought that if all the work was done by the assistant that he should have the credit, and that in all cases the chief of the department should be, if anything, overgenerous in giving credit to his assistants. Fortunately, this was usually the case now in America.

Mr. Webster called attention to the fact that when a chief has the reputation of giving credit to his assistants for the work actually performed by them, his publications have a better standing than they otherwise would, because it is known exactly who carried out each part of the work. In this way the responsibility for any of the results that are published can be definitely placed. Joint publication is all right, provided the chief has actually put the final touches on the work of his subordinates and not simply attached his name to the latter's work.

The meeting adjourned in order to hold a joint session with the Society for the Promotion of Agricultural Science, which was called to order in the same room. Mr. Fletcher introduced Professor Osborn, who occupied the chair for the joint session.

The following programme was presented:

The Economic Status of the Fulgoridæ, by Herbert Osborn, Columbus, Ohio.

Remedies for the San Jose Scale, by E. P. Felt, Albany, N. Y.

Some Results of the Use of the Lime and Sulphur Washes in Ohio, by A. F. Burgess, Columbus, Ohio.

The Cotton Boll Weevil—A Great Problem in Economic Zoology, by L. O. Howard, Washington, D. C.

Notes on the Mexican Cotton Boll Weevil in Texas, by E. Dwight Sanderson, College Station, Tex.

The second of these papers is published herewith; the remainder will be found in the Proceedings of the Society for the Promotion of Agricultural Sciences.

REMEDIES FOR THE SAN JOSE SCALE.

By E. P. Felt, *Albany, N. Y.*

Experimental work against this scale insect was begun by us several years ago, and the following is a brief summary of results:

Early spring applications of a 20 per cent mechanical crude petroleum emulsion indicated that it was one of the most effective methods of controlling this pest, and that if the spraying was properly done very little or no injury resulted to the trees. This was true not only of the more resistant pear and apple, but also of the more delicate plum and peach. Certain trees have been sprayed by us four years in succession with crude oil, and we are confident that the enlarged lenticels and very rough bark is a result. This does not seem to be a very material injury to the trees, though in one instance the foliage of a pear was deficient in size and abnormally light in color. We propose to test further the effect of continued applications, and it may be that trees can not stand it in our climate. The oil has the advantage of being very easily applied, and its tendency to run around limbs is a distinct advantage. Unreliability of mechanical pumps is a serious objection, though we believe that even this can be overcome. Somewhat to our surprise it has been demonstrated that this material (20 per cent mechanical emulsion) can be applied to peach trees in midsummer without material injury beyond dropping foliage in places where it is exceptionally thick. This heroic measure was adopted in the case of a very badly infested orchard; and an application of this character is certainly preferable to allowing the scale to breed with very little or no check.

Experiments with many lime-sulphur combinations were inaugurated last spring for the purpose of testing, in a practical way, the value of different proportions of ingredients and also of a more or less prolonged boil. Two formulæ in particular were tested; the 30-30-30 combination to 100 gallons, and the 40-15-20 to 60 gallons. The former gives a smoother wash with very little sediment, and its insecticidal value is most excellent. The latter wash has considerable more sediment and forms more of a coating upon treated trees. It was just as destructive to the scale as the preceding, so far as our observations went. A modification consisting of 25 pounds of lime and 20 pounds of sulphur to 60 gallons of water was tried, and in our own experience was fully as desirable as either of the others. It contained a little more sediment than when equal proportions of lime and sulphur are used and not so much as where twice as much lime as sulphur is employed. Tests to determine the value of salt led us to the conclusion, taken in connection with the results obtained by others, that it had comparatively little value, and we therefore omitted it from our formula. The prolonged boiling insisted upon in so many formulæ was reduced in some cases to but thirty minutes, and we found that where lime was slaked in a kettle of hot water and the sulphur added at the beginning of the operation, thirty minutes' active boiling gave a wash just as efficient as though it had been boiled two hours. Consequently we are at present recommending a lime-sulphur wash composed of 25 pounds of lime and 20 of sulphur to 60 gallons of water; slake the lime in a few gallons of hot water in a kettle, add the sulphur at once, boil actively for thirty minutes, and dilute to the required amount, preferably with warm water, though no ill effects seem to follow the use of cold water. We also tested the utility of employing a resin adhesive made by dissolving 3 pounds of sal soda in 3 quarts of water and adding thereto 4 pounds of resin and boiling until it was dissolved. This was diluted to 5 gallons and then added to the lime-sulphur wash. We found that the wash must be moderately warm or the resin solution is apt to cause coagulation and thus produce a mixture which might clog the pump seriously. This wash undoubtedly adhered a little better than where the resin was not employed, though in practical field work we could see no decided advantage from the addition of the resin.

Observations in a large apple orchard at Poughkeepsie, which has been infested with San Jose scale for thirteen years, have proved to us conclusively that it was possible to keep this insect in check. Mr. Hart used crude petroleum for two or three years, and was satisfied that it injured his fruit buds to some extent. He tried the lime-sulphur wash last spring and obtained most gratifying results. In fact, some trees which were but half sprayed gave most striking testimony to the efficacy of the application. The treated portions were practically free from the scale, while the untreated limbs were nearly covered with the pest.

A series of experiments with summer washes were undertaken, the principal material used being a modification of the lime-sulphur wash. A large series of small experiments were tried, with no very satisfactory results, except possibly in the case of one wash composed of 25 pounds of lime, 20 pounds of sulphur, and 4 pounds of resin to 240 gallons. This compound was prepared as is described for the winter wash, except that it was boiled but fifteen minutes before diluting to the required amount. It slightly burned the foliage of old apple trees and killed 85 per cent of the scale. It should be stated that this application was made September 4, and it is very probable that the leaves would stand more then than earlier in the season. We hope to continue experiments along these lines another season, and it may be that something of value will result therefrom. There is need of some more effective summer wash for the San Jose scale than the ordinary kerosene emulsion or whale oil soap solution, and while the mechanical petroleum emulsion mentioned above checks the scale in a fairly satisfactory manner, we do not like to indorse its employment to any great extent.

In discussing the papers concerning the treatment for San Jose scale, Mr. Kirkland quoted a Mr. Brown as authority for the statement that very successful work had been done by using a wash made of lime, sulphur, and caustic soda, and that no boiling was necessary, and asked the opinion of the members concerning this wash.

Mr. Felt stated that he did not have very much confidence in the efficacy of a wash prepared as directed by Mr. Brown, and that he could not advise its use. He further stated that he did not think the so-called lime-kerosene wash was what it purported to be, and that even under the best conditions only a relatively small proportion of the kerosene combined with the lime. He did not consider this material suitable for application to fruit trees.

Mr. Marlatt stated that he had just come from an examination of insect conditions in California, and that the San Jose scale had reached the stage there and the means of its control were so universally appreciated that it had ceased to be a matter of much discussion. The lime, sulphur, and salt wash is the remedy almost universally used. Its effectiveness varies somewhat with the condition of the bark of the tree. For example, it is more efficient on the comparatively smooth-barked Newtown Pippin and Yellow Bellflower, the varieties grown in northern California, and less so on the rougher-barked White Winter Pearmain, which is the common variety in southern California. Mr. Frederick Maskew, a horticultural inspector of Los Angeles County, has also noted, as he informed the speaker, that this wash, where it is not thoroughly effective, is very apt to cause an increase in the spotting of fruit, so much so that the fruit of sprayed trees is sometimes more spotted than of unsprayed trees similarly infested. This seems to come from the fact that the young from the few females escaping the treatment near or on the fruit spurs are driven by the limy coating on the bark to the young fruit and settle there, whereas under normal conditions they would remain on the bark.

Mr. Fletcher stated that one of the great objections to these washes was the fact that they required prolonged boiling, and asked if any successful experiments had been carried out in order to reduce the time recommended, especially regarding the use of caustic soda in preparing the wash without boiling, after the plan suggested by the late Professor Lowe, of Geneva, N. Y.

Mr. Burgess stated that washes made with caustic soda had been tried by Mr. Parrott, and that he reported that the results were of so variable a character that he would not recommend them for general use. He further remarked that it seemed inadvisable for the entomologist to recommend any treatment for general use unless it had proved entirely satisfactory when tried in an experimental way. He doubted the advisability of reducing the length of time of boiling the lime and sulphur wash until more tests had been made, as fruit growers are apt to fail to boil the material sufficiently, and if the proper chemical action is not complete imperfect results will be obtained from spraying.

Mr. Felt replied that he believed if the wash were boiled vigorously for thirty minutes the necessary chemical action would take place.

Mr. Piper stated that in the State of Washington the wash was thoroughly boiled for one-half hour, and when prepared in large quantities was diluted with cold water.

Mr. Summers remarked that it would seem that the conditions under which the mixture was kept must vary somewhat in the different experiments. Chemical action will evidently go on so long as the mixture is at the boiling point. As the addition of the water to the lime brings it up to this point, it would seem that all that is necessary is so to insulate the vessel in which the mixture is kept that it will not lose heat rapidly, and then to leave it for a sufficient length of time to complete the necessary chemical action between the lime and the sulphur.

Mr. Gillette remarked that he had not been called upon to use these washes for the San Jose scale, but would like to ascertain if anyone present had tried them for controlling the Cottony Maple scale. No one present appeared to have had any experience in using these washes for controlling this insect.

AFTERNOON SESSION, DECEMBER 30, 1903.

The meeting was called to order by Mr. Fletcher, and Mr. Osborn presented a paper entitled—

A SUGGESTION IN NOMENCLATURE.

By Herbert Osborn, *Columbus, Ohio.*

I presume every member of this Association has had occasion once, if not many times, to lament the fact that he is obliged by force of custom and for certainty of precision to burden his publication with two sets of names (in some cases possibly more), and I think we would hail with delight some plan which would enable us to designate certainly any particular insect by a single name or term that would be at once recognized by the unscientific reader as well as the trained biologist.

Our chemical friends seem to have succeeded better than we have, in some respects at least, for they have been able to put into common use terms which are scientifically exact and distinctive. These have become a part of everyday language, and hence many substances can be discussed in economic literature or in general assemblies without the appearance of pedantry on the one hand or the sacrifice of precision on the other. Such examples as calcium carbid or the common names of sulphur, carbon, oxygen, nitrogen, etc., are sufficient to indicate the one term for both popular and scientific use.

We should begin to appreciate that it is not the purpose of modern education to conceal knowledge in a mummy shroud of technical terms for the benefit of the few, but to use every possible means to make this knowledge accessible to the many.

There is much in the structure and life history of insects that is necessarily complex, but I believe one of the most serious hindrances to a more general acquaintance with insect life lies in the complexity and confusion and uncertainty connected with the terms we use in trying to make sure as to the particular thing with which we are dealing.

We must admit that this uncertainty does not all rest with our popular constituency, for upheavals, revisions, shiftings, and turnings in generic and specific names in any group of insects in an effort to reach a "stable" nomenclature are such that only a specialist in any limited group of insects can possibly be sure as to the latest revised combination for many of the common insects. The economic entomologist whose duties compel him to deal with insects of many orders must often be at a loss as to what generic or specific name to use in his writings to make sure that his species will be certainly recognized by other entomologists.

I venture to say that not one-half of the distinguished entomologists gathered here would be able to give off-hand the "correct" generic and specific combination for a couple of dozen common insects, to include such frequently discussed species as codling moth, oyster-shell scale, plum curculio, fall webworm, etc.

Even with access to a considerable body of literature he would have great difficulty in some cases to decide which was the latest or which was backed by the highest authority.

The name *Carpocapsa pomonella* may very likely persist for some time in economic literature, though our systematic friends now place it in Cydia. The oyster-shell scale I learned under the name of *Aspidiotus conchiformis*, a little later I knew it as *Mytilaspis pomicorticis*, then as *Mytilaspis pomorum*, then as *Mytilaspis ulmi*, and now I must again revise the name and call it *Lepidosaphes ulmi*—all this within my short experience in economic work. I am not yet the oldest relic in the field. This species, by the way, has been treated under 6 different generic names, 12 different specific names, and in 25 different combinations. *Aspidiotus hederæ*, which for assurance we may mention as the oleander scale, is about as bad, for with 3 generic names and 30 different specific names, it has had 38 different combinations.

To the beginner this confusion is especially perplexing, often disheartening, and I believe in many cases is responsible for promising students going into other lines of science where the complexities of nomenclature are less trying.

Now, I must not be interpreted as inveighing against the effort to reach a basis of nomenclature in technical entomology that will give stability and precision. As a systematist I fully realize the importance as well as the difficulty of securing stability, and I am only objecting to the insistence on carrying the conflict, with its necessary upheavals and shiftings, over into the realm of economic entomology. This branch, from its very nature, demands that its results, in order to be of service to the people, for which they are sought, shall be presented in such form that the many may understand.

I am perfectly aware that there are hosts of insects whose common or vernacular names are so indefinite, so variable, or for some reason so unacceptable that the only basis of precision lies in the acceptance of a technical name which, even if changeable, is at least traceable in successive publications.

On the other hand, we do have a number of common names which are strictly distinctive for certain widespread and familiar insects, names that have been much more persistent and unchangeable than the technical names applied to the same species, and the suggestion I wish to make in this note amounts simply to the adoption of the exclusive use of such names in all purely economic writings. Such exclusive use I would apply to a list of species approved by this Association.

For example, such names as codling moth, chinch bug, Hessian fly, pea weevil, bean weevil, Cecropia moth, plum curculio, hog louse, and many others I could name have just as definite and precise a significance to every entomologist and to every farmer and gardener as the Latin terms usually appended to them, and no confusion would ensue from omitting the variable Latin compound.

This, of course, has not always been the case, and I readily admit the need of using the additional terms in the early writings of economic entomology, but I believe the time has now come when for a considerable list of names we could safely rely on the vernacular name alone.

I do not believe in a too radical departure, but it seems to me it would be safe to adopt the following plan: Let this Association appoint a committee of its members to correspond with entomologists representing as wide a territory as possible, each one of whom should be requested to prepare a list of, say, 300 insects of widespread occurrence and for which a definite common name is used. These lists to be sent to some designated person, the secretary, for instance, or a chairman elected by the committee, who should select from the various lists such names as appear in all or in a majority of them, and thus prepare a list of, say, 100 names, which might again be referred to the members representing different districts, to be submitted to the association at the next meeting for action, and, if approved, all members be advised or urged to use in their economic writings such names only, without any Latin combination or with the Latin name at one place in article only.

It may appear at first sight that this will afford but little relief, but if we look at any bibliography we will find that the great body of written matter on economic entomology is devoted to less than 100 species. Howard says there are 73 "prime" insect pests in the United States. I am sure that of these a large proportion have a common name that has now become so definite in the literature of economic entomology as to be clearly distinctive.

Moreover, our list once established may be increased as rapidly as it is found that certain names have come to have such definite significance as to render their use secure. We have already an excellent basis for the starting of such a list in the sets of names gathered by Professor Gillette and elaborated by Professor Doran.

This list with the Latin equivalents would, of course, be published with our proceedings, perhaps in other places for standard reference, and any author who chose might have appended to his paper Latin equivalents for the names used in his paper.

One other suggestion, and that is regarding the coinage of new names. It seems to the writer that there should be an effort to secure short but significant terms where an expressive vernacular term is not already current.

The use of the generic name, a practice which is so common and generally so satisfactory in botany and to some extent in ornithology, is less available here because of the frequent change of generic names due to splitting or revision of old genera, which are unable to accommodate the grist of new species poured into the hopper.

It would be a little awkward to have to perpetuate as a common name the wheat aphis when the species has been relegated to an entirely different genus.

Mr. Fletcher considered that the matter was an important one, and suggested that a committee of three take the matter up for the Association.

Mr. Gillette considered that the adoption of such a list of common names for well-known pests would prevent some of the confusion that exists at present. He thought that the scientific name should appear somewhere in the publication.

Mr. Webster agreed with the statements made by the last speaker, and stated that he thought that there should be uniformity in nomenclature as far as possible. Much care should be taken in making up this list, and he cited the fact that in the South the name chinch bug is applied to the bedbug, and the buffalo moth to the carpet beetle in the North.

Mr. Hine called attention to the difficulties experienced by teachers on account of the continual changing of scientific names, and said that a set of uniform common names for well-known insects seemed desirable.

Mr. Felt remarked that most common names were spontaneous, and that it was necessary for the entomologist to adopt such as would be understood by his constituents. He considered the matter of common names of somewhat minor importance, though he was willing to cooperate, so far as possible, in securing the adoption of desirable ones. He did not believe it advisable to omit the scientific name, even in very popular publications, though it could occupy an inconspicuous place.

Mr. Washburn agreed with Mr. Felt, and remarked that in some parts of Minnesota several different insects were called the "squash bug," among these being the striped cucumber beetle.

Mr. Kirkland called attention to the fact that in South Africa the insect that in this country is known as the woolly aphis is there called "the American blight," and farmers would not be able to recognize this insect under any other name. It appeared to him that the economic entomologist must use the best-known common name, and that it would be no disadvantage for the scientific name of the insect to appear in publication.

Mr. Sanderson believed that the scientific name should be placed at the end of the publication, and that the work of the committee would be of great value. It is sometimes necessary to change the common names of insects, and this matter should be referred to such a committee.

Mr. Osborn stated his opinion that the time had come to make a beginning on this line of work, and offered the following resolution, which was adopted:

Resolved, That a standing committee of three be appointed, to be called a committee on nomenclature, members to hold office three years, one changing each year, to consider and recommend adoptions and changes of names in use in economic entomology; this committee being empowered to secure cooperation of entomologists in various parts of the world, as they may find advisable.

The following committee was appointed by the Chair: Mr. Osborn, three years; Mr. Gillette, two years; Mr. Webster, one year.

Mr. Piper read a brief paper, entitled:

NOTES ON PERANABRUS SCABRICOLLIS.

By C. V. Piper, *Washington, D. C.*

This large locustid has periodically for a decade caused more or less damage to the wheat fields in Douglas County, Wash., in a limited area encompassed in a radius of 30 miles. In past outbreaks the insects seem to have bred mainly in the bottoms of the large canyons known as Moses Coulee and Grand Coulee, which are 800 to 1,000 feet lower than the plateau where wheat is grown. In years when drought has caused a scarcity of food in the coulees the insects have invaded the wheat fields in great armies and, while the country was sparsely settled, ruined many isolated crops. After the country became well settled the farmers resorted to ditching to control the insect, with perfect success. Indeed, it appears that along Moses Coulee this process has reduced the numbers of the insects so greatly that for some years past they have caused no apprehension. It is stated by reliable farmers near the coulee that the insects started to return to the lower altitudes when ready to oviposit, and that by ditching against this return very few of the invading army escaped. Whether the insects actually do return in an army to the coulees to oviposit is questionable. This conclusion of the farmers is based largely on the fact that the insects occur every year in the coulee bottom, and only when their numbers make food scarce do they migrate out of the canyon to the plateau above.

In 1902, and in far greater numbers in 1903, the insects appeared on the south slope of Badger Mountain. This land has been settled only within the last five years. The outbreak during 1903 was so serious that the county authorities appropriated funds to combat the insect, which in its march reached within a few miles of Waterville, the oldest wheat-growing region in the county, and where the insect was never before known. It was found much cheaper to stop the insect by fences made of 1 by 12 smooth boards placed on edge than by ditches, and after these were built the progress of the insect was stopped, but not before several thousand acres of wheat were destroyed. Those of the insects not destroyed oviposited in the soil near the barrier fence. No evidence whatever was seen of any return migration to other breeding grounds.

It is evident that the control of this locustid offers no difficult problem, and it is possible practically to exterminate it by no other means than fencing or ditching.

Attempts were made in 1902 and again in 1903 to inoculate it with the South African Mucor, but all the attempts proved fruitless. If a disease could be found, the chances of its spreading are particularly favorable, owing both to the insects' habit of congregating in great numbers at night in the shelter of plants and low bushes and from the further fact that they are cannibalistic.

The distribution of this insect is remarkable. It was described by Thomas from specimens collected in 1872 in the mountains of southwestern Montana at an altitude of 9,000 feet. No other collections have been made since except these recent ones in Douglas County. In Washington it seems to be normally an Upper Sonoran insect, only occasionally invading the transition zone. The Montana types are from the boreal zone, and as they are well preserved there can be no question as to the identity of the Douglas County insect, which matches the types exactly.

Scudder's monotypic genus Peranabrus is founded on Thomas's *Thamnotrizon scabricollis* and differs from Anabrus only in its roughened pronotum.

In answer to a question asked by Mr. Felt as to whether this species devasted the country as they marched along, Mr. Piper replied that they fed upon the grass, and were also carnivorous to some extent.

Mr. Fletcher asked if it were not possible that these large crickets were largely carnivorous; he had eviscerated a large number of *Anabrus purpurascens* when preserving them, and had never found any vegetable matter in their stomachs. He also remarked that the latter species was abundant in Manitoba.

The next paper was presented by Mr. Burgess:

NOTES ON ECONOMIC INSECTS FOR THE YEAR 1903.

By A. F. BURGESS, *Columbus, Ohio.*

In general in may be said that few serious outbreaks of destructive insects have appeared in Ohio during the past year. The chinch bug (*Blissus leucopterus*) and the Hessian fly (*Cecidomyia destructor*), two of the prime agricultural pests of the State, have caused little damage. One of the reasons for the disappearance of the latter is probably due to the fact that farmers are learning to sow their wheat late enough in the fall to escape the second brood of this insect.

During June and July great damage was caused to apple stock in the nurseries in the northeastern part of the State by the apple aphis (*Aphis mali*), and where no effort was made to control this insect many small trees were ruined. I have also been informed that the same conditions prevailed in New York, especially in the vicinity of Geneva. One of the leading nursery firms near Painesville, Ohio, tried many different remedies, but the best results were obtained by dipping the tops of the young trees in a wash made of whale-oil soap, tobacco extract, and water. This was prepared by dissolving 1 gallon of whale-oil soap in 50 gallons of water and adding 1 gallon of tobacco extract to each 75 gallons of this mixture. The tobacco extract was purchased from a firm in Louisville, Ky. Continuous applications were necessary in order to control the insect, but by following up this treatment serious injury to the trees was prevented. The leaves of birch trees growing in this region were also attacked by an undetermined species of aphis and many were seriously injured.

In other sections of the State, particularly in the nurseries where a careful examination of existing conditions was made during the summer, no unusual abundance of aphides was noted.

The reports of the Weather Bureau show that the rainfall for northeastern Ohio for the period from the middle of May until early in July was several inches above, and the temperature was considerably below, the normal for this region. These conditions were undoubtedly favorable for the reproduction of this insect and proportionally unfavorable for the increase of its parasitic and predaceous enemies, and as there was a good supply of overwintered eggs an outbreak was inevitable.

On August 24 Mr. E. C. Cotton, one of my assistants, while inspecting a nursery near Bucyrus, found that the roots in a block of 1-year-old apple seedlings were being eaten by a white grub (*Lachnosterna* sp.?) to such an extent that some of the trees were dying. The land had been in corn the previous year, and as the nursery stock was kept free from grass and weeds it was evident that the insects were forced to attack the small roots on account of lack of food. The outer tissue was eaten in some cases for several inches, but the roots were not severed, as is the case when grass is attacked. The grubs appear to prefer the outer tissue to the more fibrous and woody material within. In a letter received from the owner December 22, 1903, it is estimated that 20 per cent of the trees have been destroyed.

The cankerworm (*Paleacrita vernata*) occurs locally throughout the State, and during the past few years has done a great amount of damage to apple orchards and in some sections the elm trees have been defoliated. The prospect for a destructive brood last spring was very promising, as many orchards contained large numbers of the young larvae. Early in May the temperature in many parts of the State dropped below the freezing point and in some places ice was formed in the blossoms, so that a large percentage of the prospective fruit crop was ruined. After this time few of the worms could be found in many of the infested orchards, and as this is the testimony of a large number of careful observers it is fair to presume that many of the small worms were killed by the cold weather.

A general investigation of the cankerworm problem has brought out the fact that the spring species predominates throughout the State. The fall species (*Anisopteryx pometaria*) is only known to occur in two localities in Columbus, and in one of these colonies, which is near the State university, the females were found depositing their eggs November 23, 1903.

The San Jose scale (*Aspidiotus perniciosus*) continues to inflict serious injury to fruit and ornamental trees and shrubs, and is causing large expenditures of both time and money by orchardists and landowners. It has to a large extent remained unchecked in cities and towns, and many trees and shrubs are now in a dying condition as a result of its attacks.

During the past season the lime and sulphur washes have come into prominence both experimentally and commercially. Treatment of peach orchards with either the California or the Oregon wash has given satisfactory results. In a few cases slight injury to the twigs has been noticed, when the former wash was applied, about the time that the buds were starting in the spring. Only a few apple orchards have been sprayed with these washes, but as a rule the scale has been reduced by their use. The cheapness and efficiency render them desirable for spraying operations, and they will be the chief insecticides used against this insect during the coming year.

A colony of the Asiatic ladybird (*Chilocorus similis*) was received August 17, through the courtesy of Dr. L. O. Howard, and the two beetles that survived shipment were placed in a peach orchard in Clermont County, which was badly infested with the San Jose scale. A hurried inspection October 28 revealed the presence of twelve beetles, which shows that one generation has been produced. As Clermont is one of the most southern counties in the State, it is hoped that this colony will survive the winter and thus add another beneficial insect to our present list.

Although the woolly aphis (*Schizoneura lanigera*) is a common insect throughout the State and at times attacks the roots of nursery stock so as to render it unsalable, it has not, so far as is known to the writer, caused serious injury to orchards. While inspecting an apple orchard near Thivener, in Gallia County, my assistants, Messrs. H. J. Speaker and G. A. Runner, found several trees in a 12-year-old orchard that were in a dying condition. About twenty of these trees were growing on a hillside and three of them were nearly dead. They proved to be badly infested with this insect, both above and below the ground. A photograph of the roots of one of these trees that was removed shows that this pest had practically killed the tree. Mr. Haffelt, the owner, informs me that the trees in this orchard were of the Rome Beauty and Ben Davis varieties, and had been planted about twelve years. Doubtless they were infested at the time of setting. Three small crops of fruit had been picked from this orchard, but it is probable that none of the trees will recover from the injuries caused by this insect.

The grape root-worm (*Fidia viticida*) has caused considerable damage to the vineyards in northern Ohio. The foliage showed abundant indications of the work of the beetles, but I am informed that where thorough cultivation and spraying was practiced the injury done by the insect was less than in previous years. The fact remains, however, that many acres of vines have been pulled out and the land planted to other crops on account of the expense of fighting this insect and the grape rot, which is prevalent in this district.

The grape berry moth (*Eudemis botrana*) has been particularly abundant and destructive this year. Mr. T. J. Clymonts, of Cleveland, who controls large vineyards near Euclid, Ohio, informs me of the destruction of the entire crop on 16 acres of Catawba vines. The berries were so badly infested that they were unfit for use in making wine.

The oyster-shell bark-louse (*Lepidosaphes ulmi*) is present in destructive and increasing numbers in northern Ohio, particularly in Cleveland and vicinity. Apple, poplar, and willow trees and lilac bushes are commonly found completely incrusted with the scales and in a dying condition. Failure to apply contact insecticides at the time when the lice are hatching in the spring is largely responsible for the increase. It is a noticeable fact that this is the only section in the State where this species is causing any considerable amount of damage.

The willow curculio (*Cryptorhynchus lapathi*) has continued to spread, and was found this year in Painesville, several miles west of any point previously noted.

An outbreak of the white-marked tussock moth (*Orgyia* [*Hemerocampa*] *leucostigma*) occurred in Cleveland during the summer, and many shade trees were defoliated. I am informed by Mr. M. H. Horvath, who is the superintendent of the city parks, that the trees in some localities were defoliated by the last of July and that the succeeding growth of leaves which the trees put forth were devoured by the second brood of larvæ. As the trees in this city, except in the parks, have a desperate struggle to maintain an existence, few will be able to survive any continued amount of defoliation.

Late in August the black locusts that are abundant on the hills in the valley of the Ohio River were badly stripped by the small beetle *Odontota dorsalis*. The trees were bare and brown in many localities, and the defoliation was general from Gallipolis, Ohio, to Guyandot, W. Va., a distance of over 50 miles. Mr. Runner, my assistant, who reported this outbreak, states that he was informed by parties who had traveled extensively through West Virginia that the same conditions existed in the Cumberland Mountains. It would not pay to carry on any extensive work for the suppression of this insect, but in case persons are planting locust trees to be used for posts or poles, as is the case in some sections of this State, it is possible that this insect may cause considerable loss.

Mr. Webster stated that while in Ohio he had planted, at Wooster several apple trees, the roots of which were badly infested with the woolly aphis. The young trees had made a good growth, but he was unable to state what their condition was at the present time. He called attention to the fact that he had reported the defoliation of the locust trees along the Ohio River by *Odontota dorsalis* about seven years ago.

A paper was next read entitled—

OBSERVATIONS IN 1903.

By E. P. Felt, *Albany*, N. Y.

The following brief accounts relate to some of the more important species brought to notice during the past season. The year will be remembered on account of the exceeding abundance of plant-lice, particularly of species of economic importance. The attack was not only characterized by excessive severity, but also by an undue prolongation, and this latter may have been due in part to unusual rains, which were not favorable to the comparatively unsheltered natural enemies, and therefore probably hindered them in their beneficial work. The apple-tree plant-louse (*Aphis mali* Linn.) was one of the most conspicuous of the destructive forms, and its ravages were so marked that entire trees had their foliage smeared with honeydew, blackened with the sooty fungus, and eventually lost a considerable proportion of their leaves. Young trees showed the work of this pest more than older ones; but even in the case of those in bearing the development of the fruit was severely checked. Plant-lice of this species appeared about the last of May, were more abundant in June, continuing through July and, in some cases at least, even to the middle of August. The conditions in the nursery were no better than in the orchard, and a correspondent reports that this species obliged him to keep a gang of 15 or 20 men and boys at work continuously in the nursery with a whale oil soap solution, and some nurserymen found themselves almost unable to cope with the pest. The severe injuries led us to experiment with whale oil soap solution—1 pound to 4 gallons—with the result that it killed all the plant-lice touched without injuring the foliage to any extent. We, however, believe that thoroughness is of more importance than using a strong insecticide.

The cherry plant-louse (*Myzus cerasi* Fab.) was also generally destructive throughout the State, and in some cases inflicted very serious injury. We have in mind certain small trees in Chautauqua County which were so badly infested that nearly one-third of the leaf-bearing portion of the twigs had the foliage so badly affected that it curled, died, and dropped by midsummer. The injury was so great that one or two trees died, probably as an indirect result of the severe drain upon their vitality. The plant-louse on Norway maples (*Chaitophorus* (?) *aceris*) has likewise been exceedingly abundant and injurious, affecting trees so seriously that practically all the foliage was smeared with honeydew and discolored by fungus. In a few instances the leaves were so badly curled and stunted that they presented only about one-quarter the usual surface, and the trees, instead of being objects of beauty, were monuments of misery and an eyesore on the landscape. The elm aphis (*Callipterus ulmifolii* Mon.) was also generally abundant upon American elm and occasionally exceedingly injurious. The foliage of affected trees was smeared with honeydew, blackened, and the borders of the leaves turned yellowish by midsummer. Affected trees presented a very miserable appearance. The delicate and beautiful plant-louse (*Drepanosiphum acerifolii* Thos.) was likewise very abundant on hard and soft maple in various sections of the State and caused considerable dropping of the foliage. The birch aphis (*Callipterus betulæcolens* Mon.) was abundant and excessively injurious to birches, particularly the cut-leaved variety. The outbreaks of various species of plant-louse were largely checked by hosts of natural enemies, such as ladybugs, syrphus, and lace-winged flies.

Diplotaxis liberta Germ. is rarely brought to notice on account of its depredations, and the complaint by John R. Crandall, of Hauppaupe, that the beetles had stripped all the foliage from many young peach trees in an orchard of about 30 acres was somewhat of a surprise. He states that they work at night, burying themselves in the dirt during the daytime, and that anywhere from 10 to 50 were found under each tree, they apparently preferring Albertas. He found the insects nowhere except in the peach orchard. A search of economic literature resulted in finding no references to this species, and only one or two to allied forms which had caused, in the case of *D. frondicola* Blanch., considerable injuries to leaves of rose, mountain ash, and wild plum in an Iowa nursery in 1871, and in that of *D. harperi* Blanch., damaging strawberry plants at Campbellsburg, Ind., in 1894.

The codling moth (*Carpocapsa pomonella* Linn.) is a well-known pest which has been studied for a number of years, and we were surprised to meet with many larvæ on a young apple tree, which had entered galleries made by borers, and in excavating pupal cavities had not refrained from eating into living tissues, where they caused considerable bleeding and at first sight led one to suspect that the injury was due to the round-headed borer. The tree in question has a trunk about 6 inches in diameter, and some 12 or 15 larvæ were taken from several of the cavities. Three or four of the caterpillars were found contiguous to living tissues, which had been recently gnawed and from which considerable sap was flowing. The borings were conspicuous, and many of the pellets were covered with exuding sap. It is well known that larvæ of this species gnaw pupal cavities in dead bark, though our attention has never before been called to its working in this manner in living tissues.

The pear psylla (*P. pyricola* Forst.), like various species of plant lice, distinguished itself by its remarkable abundance and excessive depredations in many fruit-growing sections of the State. The injury was much more general and severe than has been observed before, and the explanation is probably found in the unusually favorable climatic conditions. Evidences of great damage began to appear in June, and during July and August the trees presented a truly wretched sight. In some cases the injury was so severe that most of the fruit dropped. One correspondent, Mr. H. D. Lewis, of Anandale, reports the crop of his section a failure on account of the work of this pest.

The San Jose scale (*Aspidiotus perniciosus* Comst.) developed in unusually large numbers toward the latter end of the season, and as a consequence many infested trees were literally covered by this pest. The rapidity of its spread in a locality is of considerable importance and is undoubtedly influenced by a number of factors. The insect has been in the large orchard of Mr. W. H. Hart, of Poughkeepsie, for thirteen years, and yet it has failed to spread to any great extent, portions being practically free even after the lapse of years. A close examination of the center of infestation existing at Clinton Heights shows that while the insect has been present there for about the same time there has been no extensive spread, it having made its way through a number of small gardens only about one-eighth of a mile in one direction, while it has failed to cross a road to orchards even nearer in another direction.

One infestation was discovered fully a quarter of a mile distant in another direction, but this was due to its having been carried upon trees and not to a normal spread. It should be stated that in both of these cases the scale has been kept in control as a rule, and as a consequence the spread has not been nearly so rapid as if the reverse had been true. On the other hand, investigations and inquiries in a peach-growing section where the scale had become established in a few places three or four years ago reveals the fact that the pest has already obtained a foothold in some orchards from half a mile to 2 miles or thereabouts from others, and in this instance we are inclined to believe that these colonies established at a distance are due to the fact that no very adequate control of the insect has been maintained.

The distribution of insects is one of considerable importance to economic entomologists, and it is interesting to report the presence of the common asparagus beetle (*Crioceris asparagi* Linn.) at Glens Falls, Warren County, where it has become established over an area several miles in extent. This is the northernmost New York locality we know for this species. The cabbage maggot (*Pegomya brassicæ* Bouché) has been unusually injurious in various sections of the State, and has been reported as destroying one-fourth of the crop in St. Lawrence County, besides causing damage in other sections. The onion maggot has also been very injurious, and in St. Lawrence County it ruined one-fourth of the crop, besides causing considerable damage in the vicinity of Albany and probably in other sections.

The saw-toothed grain beetle (*Silvanus surinamensis* Linn.) is a well-known species, and in this country has attracted little attention as a household pest, aside from its annoying presence in cereal preparations and similar materials. The past summer our attention was called to a curious condition in which this species figured as a household pest. The conditions were as follows: The insects bred in immense numbers in a bin of a brewery containing several thousand bushels of oats, and on warm days appeared in large numbers and invaded nearby dwellings. They were so numerous in infested houses that they made their way into everything, and the housekeeper could sweep up nearly a pint on any warm day. They were found in all parts of the dwellings, resting upon ceilings, crawling upon walls, under mats, tablecloths, etc., and even invaded wearing apparel. They were found in shoes and made their way into beds, and caused not a little discomfort by a slight biting or possibly pricking by the serrate edges of the prothorax.

Shade-tree pests have not attracted special notice on account of their depredations, though the elm leaf beetle (*Galerucella luteola*

Müll.) was present this year in enormous numbers in the village of Saratoga Springs, and would have caused serious injury had it not been for the thorough and systematic spraying conducted by village authorities. This species has also been reported as being present in very large numbers at Schuylerville, only a short distance from Saratoga Springs. The depredations of the white-marked tussock moth (*Notolophus* [*Hemerocampa*] *leucostigma* Abb. & Sm.) have not been so excessive as usual, though the pest was generally present in the city of Buffalo and partially defoliated thousands of trees.

Mr. Felt remarked, after reading his paper, that a bulletin concerning the grape root-worm was now in the hands of the printer, and would be distributed at an early date. He had found that where poison was applied to foliage which made a rapid growth, as is the case with grape vines in the spring, that it was not effective in holding this insect in check.

Mr. Gillette stated that during the past year apple and cherry trees in Colorado had been badly infested with aphides. He had found from observation, however, that many of the eggs which were deposited in the fall failed to hatch during the following spring. He estimated that not one in 1,000 of the eggs laid in the fall of 1902 hatched last spring. In spite of this fact there was an abundance of plant-lice present in June.

Mr. Cooley had observed the same fact in Montana, and remarked that many growers were inclined to give up apple culture because of the serious damage to young orchards caused by the apple aphis. He had observed that a ladybird (*Hippodamia 5-signata*) was very abundant and destroyed many of the lice.

At this point two papers sent by Mr. Slingerland were read by the secretary. They were entitled "Some Serious Insect Depredations in New York in 1903" and "Notes and New Facts about some New York Grape Pests."

SOME SERIOUS INSECT DEPREDATIONS IN NEW YORK IN 1903.

By M. V. Slingerland, *Ithaca, N. Y.*

The year 1903 may be recorded in the entomological annals of New York as one noted for an excessive and unprecedented development of plant-lice and the pear psylla, which were generally destructive throughout the State.

PLANT-LICE.

The foliage of shade trees, especially maple, elm, cut-leaved birch, and purple beech, swarmed with plant-lice in many localities. Young fruit trees—apples, quinces, plums, pears, and cherries—in nurseries and in orchards were so badly infested that growth was seriously checked and the trees in many cases permanently injured. Two nurserymen report that their losses would aggregate $5,000 each. Apple and sweet cherry stocks suffered the most; sour cherries beside badly injured sweet varieties were not touched; some varieties of apples were damaged more than others, and the infestation was worst in certain spots in some nurseries. But the most surprising and destructive work was wrought by these little pests in many large bearing apple orchards in western New York. Reports reached us in June that large prospective crops of apples were being ruined by plant-lice. So unusual is it for these insects to appear in sufficient numbers to injure the fruit that we could hardly believe our eyes when we visited some infested orchards. The young fruits were swarming with the lice, which had stunted their growth and given the fruits a misshapen, knotty appearance, as shown in Pl. II. One large apple buyer stated in the autumn that it was very difficult to pack good stock in the infested orchards. One grower reports that he thinks his crop was reduced one-half by the lice.

We believe that certain weather conditions and a scarcity of their natural enemies were potent factors in causing this unusual outbreak of plant-lice. We found but comparatively few of their enemies, like the ladybird beetles and their grubs, the lacewing flies, and the Syrphus flies, in the infested orchards in June. Later in the season some of their enemies "rose to the occasion" and reaped a rich harvest, often cleaning trees completely of the lice. It is possible that the excessive wet season of 1902, or perhaps an extreme dry period in the spring, may have been unfavorable for the development of these natural enemies and favorable for the plant-lice. We have but little definite knowledge of just what weather conditions cause the "ups and downs" of insect life. Can not this Association devise some scheme for filling in this much-needed chapter in our insect-life book?

We found both the rosy apple aphis (*Aphis sorbi*) and the apple leaf aphis (*Aphis pomi*) in the infested orchards in June, but it is quite probable that Fitch's apple aphis (*Aphis fitchii*) was also abundant on the buds earlier in the season. Owners of large orchards made little or no effort to check the lice, but many young orchards and hundreds of acres of nursery stock were treated several times with the usual oil and soap mixtures with good success where the work was thoroughly done. We can offer no definite predictions for 1904, but it is very doubtful if plant-lice are again as numerous in several years in New York.

THE PEAR PSYLLA.

The summer broods of this serious pest swarmed over most New York pear orchards last season, and much damage was done; even dooryard trees all over the State were overrun by the psyllas. It was the most general infestation that has occurred in New York. Except the San Jose scale, this psylla is the most destructive insect pest of the pear. Its ravages seem to be increasing in New York, and it has come to be nearly as standard a pest as the codling moth or plum curculio. Only the most thorough work with an oil or soap spray (whale-oil soap, 1 pound in 5 to 7 gallons water, kerosene emulsion diluted with 7 to 10 parts water, or an oil and water spray of 10 to 15 per cent of oil) will control the psylla. Some orchardists with very tall standard trees are now discouraged after fighting the pest nearly every year for ten years. Prompt and thorough work early in the season is necessary in fighting the psylla.

SNAILS OR "SLUGS."

Large numbers of small shell-less snails or "slugs" ravaged young corn, beans, and tobacco plants in central New York in June. In one case 10 acres of beans were badly injured, the "slugs" riddling the leaves and eating into the stalks. Doubtless the wet season of 1902 was very favorable for the development of these moisture-loving animals. A dry spell in July checked their ravages and prevented the carrying out of some experiments we had planned. Some hand-picked them at night, and a strip of salt kept outsiders from getting into a bed of seedling tobacco. Doubtless a poison spray or dust will check these "slugs."

THE ROSE-CHAFER.

There are several very sandy spots in New York where rose-chafers breed and swarm onto near-by strawberry beds, vineyards, and cherry and apple orchards. The beetles appear in these limited areas every year, but they were unusually numerous in 1903. We are convinced that much can be done to check this pest by thorough and timely cultivation of their breeding grounds when they are in the pupa state in May. Grape-root-worm pupæ and wireworm pupæ are easily killed in this way, and why not rose-chafer pupæ also? We shall try very strong doses of arsenate of lead in the menu of the beetles in 1904 if they again appear in destructive numbers.

THE APPLE BUCCULATRIX.

This little pest has again swung into its "up" or destructive period in New York, and last season the foliage in several apple orchards in central New York were badly skeletonized by the tiny caterpillars. A bulletin will soon be issued from the Cornell experiment station on this insect. We have observed several new and interesting phases of its life, and were able to get a series of photographs of the heretofore unobserved process of the making of the cocoon. The common name now in use for this insect has long been a stumbling-block to us, and some systematist is liable to put the insect into another genus any day. We like the name of "ribbed cocoon-maker of the apple" better than any other we have been able to get, for it is suggestive of that phase of the insect which is usually the first to attract the orchardist's attention.

THE APPLE-LEAF BLISTER MITE.

The pear-leaf blister mite is now a well-known pest in many sections of the country, but never before until last summer had we seen or heard of a similar pest in apple leaves. Scattered through central New York there were many apple trees with many of their leaves showing the corky blisters characteristic of these mites. We have not yet made a careful study of the mites to determine if they are the same as the pear species. The blisters in the apple leaves differ slightly from those in pear, but this may be due to the different food-plants.

CABBAGE AND ONION MAGGOTS.

Much loss resulted in the large cabbage and onion sections of New York last season from these maggots. Apparently no one made any effort to check the pests.

GRAPE PESTS.

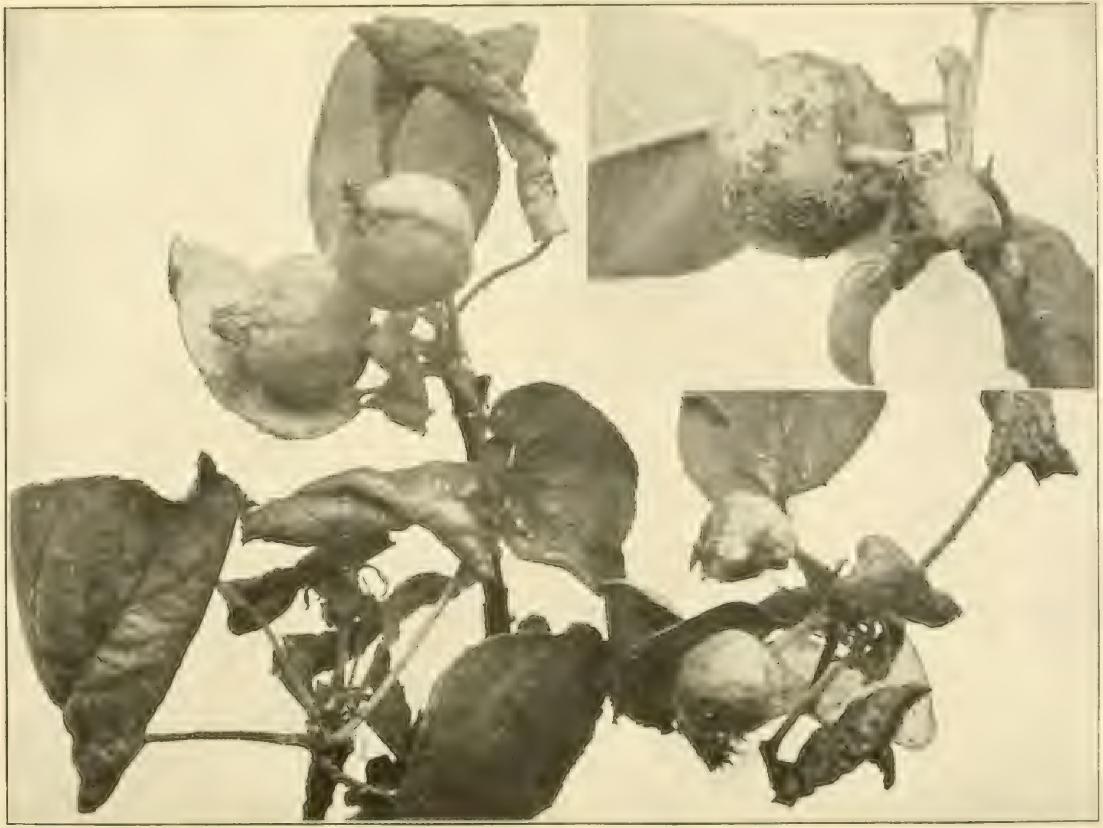
The ravages of three grape pests in Chautauqua County have been discussed in another paper in these proceedings.

THE PLUM CURCULIO.

Many New York plum and cherry growers have long desired a less laborious method than the "jarring" process for fighting this pest. Poison sprays have been recommended and tested for many years, and some think they succeed in controlling the insect in this way. Last season several growers made thorough tests of arsenate of lead, and the results were very gratifying on both plums and cherries. It was used at about 2 pounds in 50 gallons of water or Bordeaux mixture and applied thoroughly two or three times soon after the blossoming period. Recent experiments in other States show that this poison is more effective than Paris green and similar poisons in fighting the codling moth. Thus the indications are that arsenate of lead will come into more general use.

AN HISTORICAL NOTE ON THE CODLING MOTH.

We insert this note simply to place on record some observations on the eggs of this insect which were recorded in Italy in 1857. The account was overlooked in some unaccountable way when we made an exhaustive survey of its early literature in 1898. In 1857 A. Costa published an important work on the insects infesting fruit trees and



DESTRUCTIVE WORK OF APPLE PLANT LICE ON FRUIT AND LEAVES ON LARGE TREES IN NEW YORK IN 1903

From photograph by author.

dry seeds. On pages 95–100 he discusses the codling moth, and on plate 6 of his work some fairly good figures of all stages of the insect, including the egg and its position on an apple, are given. He describes the egg as "spheroidal, with walls delicately membranous, somewhat netted, transparent, of a whitish-yellow color," and states that the eggs are most often laid in the neighborhood of the stem or calyx. Thus there is little doubt that Costa saw the eggs nearly fifty years ago.

NOTES AND NEW FACTS ABOUT SOME NEW YORK GRAPE PESTS.

By M. V. Slingerland, *Ithaca, N. Y.*

During the past three or four years many vineyards in the great Chautauqua County grape region have been very seriously infested by three insect pests—leaf-hoppers, rootworms, and the fruit moth. Never before had any of these pests menaced this grape section, and the vineyardists were wholly unprepared to cope with such new difficulties. The entomological and horticultural divisions of the Cornell Experiment Station and State Entomologist Felt devoted a large part of their energies to field work in the infested region in 1902 and 1903, and some work will probably be carried on next year. Apparently one of the factors which brought about this unusual outbreak of these grape pests was neglect in cultivating and feeding the vineyards a few years ago when grapes brought very low prices. It has been demonstrated that proper and timely cultivation is one of the most effective methods for controlling the rootworms (*Fidia viticida*), and nothing suits the "hoppers," as the growers call them (*Typhlocyba comes*), better for hibernation quarters than a grass-grown and weedy vineyard. The fruit in some of these neglected vineyards was not worth harvesting, and oftentimes grapes are sorted in the field, the wormy and diseased berries being thrown on the ground near the vines. These conditions favor the unhampered breeding of the fruit moth (*Eudemis botrana*).

It has been a strenuous warfare to devise, test, and evolve effective and practical methods for controlling these grape pests, but the results have demonstrated that such methods are available.

The rootworm is vulnerable in its egg, pupa, and beetle stages. Some vineyardists have found it practical to go over their vines and by rubbing the canes crush the masses of eggs laid under the loose bark. The pupa rests in a little earthen cell, and but few of them survive if this cell is broken by cultivation. More than half of the pupae can often be killed in this way by thorough stirring of the soil in June.

The beetles feed quite extensively on the leaves, eating characteristic chain-like holes. Thus theoretically they should succumb readily to a poison spray. Although many acres of infested vineyards were sprayed with arsenate of lead in 1902, such excessive rains fell that no conclusive results were obtained. But last season similar spraying experiments with arsenate of lead (4 pounds in 50 gallons of water) gave some very promising results. In one vineyard three plots of vines gave the following striking results: On the unsprayed vines the leaves were badly eaten by the beetles, and on 10 vines 97 egg clusters were found; on vines sprayed once the foliage was but little eaten, and only 7 egg clusters were found on 10 vines; one plot was sprayed twice and there were scarcely any signs of the foliage being eaten, and a careful examination revealed but 1 egg cluster on 10 vines. These are certainly astonishing results, but the spraying was thoroughly done, and there is scarcely a chance that any peculiar conditions could have influenced the results when the plots were practically side by side in the same vineyard. Furthermore, another reliable vineyardist in another town who sprayed a large portion of his vineyard but once feels very sure that he accomplished much toward controlling this destructive pest, and an examination of his vines in comparison with a neighbor's across the road gave very encouraging results. Further spraying will be done next season in a vineyard into which a swarm of the beetles migrated and fed extensively last summer from a badly injured vineyard across a meadow 30 or 40 rods away. This migration of the beetles in a body from one vineyard into another thrifty one affording better pasturage for themselves and their grubs later is a new and very alarming fact, for it means that the best-cared-for vineyards are constantly menaced by neighboring infested vineyards where no fight is being made against the pest. Doctor Felt has captured thousands of the beetles in a "catcher," designed to be drawn along on each side a row of vines. Other hand "catchers" have been devised, but most vineyardists are waiting for a more conclusive demonstration of the effectiveness of this laborious method before they will put it into practice.

Mr. P. J. Parrott informs me that this rootworm, which has devastated Ohio vineyards for several years, is now in its "down" or non-destructive period and is comparatively scarce in the infested region. There are some indications that it is also disappearing as a pest from the earliest-infested region in Chautauqua County, N. Y.

An outbreak of that common grape pest, the grape leaf-hopper, unprecedented in extent and destructiveness in the annals of New York, has occurred in nearly the same region infested by rootworms in Chautauqua County during the past three years. More than a thousand acres of vineyards have been infested to the extent that the vines did not make growth enough to furnish sufficient wood to tie up for the next season's crop, and the foliage was often killed in early fall, and thus the proper coloring and ripening of the fruit and wood was prevented. No vines were killed, but it will be two or three years before many vineyards regain their normal vigor. After a long, hard, and sometimes discouraging warfare in 1902 against the "hoppers," we demonstrated that they can be effectively, practically, and cheaply controlled. The details of our work will appear in Bulletin No. 215 of the Cornell Experiment Station.

We finally devised a large, practicable, sticky shield (fig. 1) for catching thousands of the adult "hoppers" in the spring on considerable areas. The trouble with many of the previous recommendations for this pest is that they are impracticable or too expensive to operate in large vineyards. We could not get New York vineyardists with 10 to 100 acres of vines to use a sticky fan or shingle. We were unable to kill many of the adult "hoppers" with a spray or dust of any kind that did not injure the leaves, until we finally tried the cowardly scheme of "hitting them when they were down" with a 25 per cent mechanical mixture of kerosene. We found that a 5 per cent kerosene mixture would not injure the leaves and would bring the "hoppers" to the ground, where they would remain a few moments wiping it off. Continuing this to the end of a row of vines, the pump was set to throw 25 per cent of oil, and going back the same row, this spray was directed at the "hoppers" on the ground. We killed thousands of them in this way, but soon found that none of the

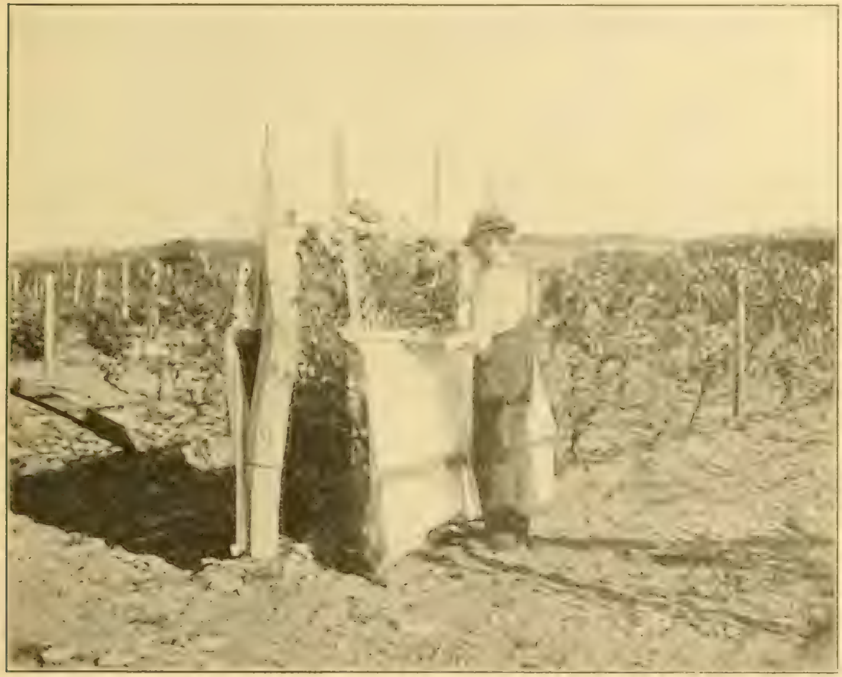


FIG. 1.—A practicable, large and efficient sticky shield for capturing adult grape leaf-hoppers in the spring (from photo by author).

several oil and water pumps we used could be depended upon to throw the scheduled amount of oil. The supposed 5 per cent oil spray varied so much that too much injury resulted to the foliage and we had to abandon these pumps. We believe it is practicable to use two pumps, one for whale-oil soap (1 pound in 5 gallons of water) to knock the "hoppers" down, and the second an oil and water pump with a longer hose to follow close behind and hit them on the ground with a 25 per cent oil spray. Water will not bring down satisfactorily. It is of the utmost importance to kill all of the hibernated adult "hoppers" possible in the spring, for they often do as much injury as their children later in the season. We believe that if 50 to 75 per cent of them could be killed then that the vineyards would not suffer seriously during the rest of the season.

The young "hoppers" or nymphs are quickly killed when hit with a weak soap or oil spray. We sprayed many acres with whale-oil soap (1 pound in 10 gallons of water) early in July, with very successful results. The keynote to success is in hitting the little nymphs on the undersides of the leaves. To do this it is necessary to stop at each vine and with underspray nozzles direct a forceful and fine spray onto the undersides of the leaves. Vineyards can be thoroughly and effectively treated in this way in July for about $5 per acre, and one treatment is usually sufficient to reduce the pest far below the danger limit. Our sprayed vineyards remained green until frosts came, and the fruit and wood thus fully ripened. The fruit sold above the market price, as it was riper and sweeter.

As no one had worked out the life history of this common pest, we made careful studies in the field and insectary, which resulted in many new and interesting facts. Recent writers have guessed there were three or more broods of the "hoppers" in a year. Our observations, extending over two years, lead us to the following conclusions regarding the life and habits of the grape leaf-hopper in New York. The adults hibernate largely in nearby grass and woodlands, and emerge about May 1 to feed for two weeks or so on various plants, as strawberries, dewberries, and raspberries, their reddish, winter coloring changing to a lemon yellow; then they go to the grape foliage, and the insect spends the rest of the season thereon. About June 1 egg laying begins and continues for several weeks, the eggs being stuck just beneath the lower skin of the leaves, usually one in a place, but sometimes six or more in a row. They hatch in about two weeks. The young "hoppers" live on the undersides of the leaves through five different nymph stages, their cast skins often remaining on the leaves for weeks. The nymphs run rapidly, but, contrary to tradition, they do not hop or leap. After about five weeks of this nymphal life they appear as flying and leaping adults in August. Evidently some of the first of these adults to appear lay eggs which develop a partial second brood of nymphs in New York, but most of them soon take on their protective, reddish, winter coloration, and in October go into hibernation. Some of these hibernating adults doubtless live from one August until the next, or for nearly a year. There is but one full brood and a fragment of a second brood of the insect in New York vineyards in a year. Apparently the life pendulum of the grape leaf hopper has begun its downward swing after an "up" period of great destructiveness for two years, for last season they were not so numerous, although millions of them went into hibernation in the fall of 1902.

The grape fruit moth has been unusually numerous in some vineyards in Chautauqua County for two or three years, sometimes more than half the fruit being ruined. We have not yet observed the spring and early summer life and habits of the pest. In August we readily found the eggs stuck onto the skin of the fruits in various localities. They remind one much of the codling moth's egg. The accepted notion has been in this country that this fruit moth is the same as the European species, and that it hibernates as a pupa in its cocoon made inside a peculiar flap cut from the leaf. In 1899 an exhaustive account of 75 pages about the European species appeared in Italy.[a] There the third or last brood of larvæ spin their hibernating cocoons under the loose bark of the older parts of the vines or on their supports, while the cocoons of the first and second spring and summer broods that work on the flower clusters and growing fruits are made among the flowers or on the leaves of grape and various other plants. In October, 1903, we made a very thorough examination of many vines in a badly infested vineyard and failed to find any cocoons except on the fallen leaves. Either we have a different species from the European grape fruit moth or else it has quite a different hibernating habit in New York. One of the systematists who is studying this group of moths tells me that there seem to be at least two different species now labeled *Eudemis botrana* in our collections. In the Murtfeldt collection now at Cornell University there is probably the largest series of bred specimens of moths under this label in this country, and it is quite evident at a glance that there is more than one species in the material. As soon as authentic European material can be obtained we hope to arrive at some definite conclusions regarding the identity of the American grape fruit moth. We also expect to carefully compare our insect in its various stages to see if it corresponds in all its details with the many figures given for the European species in Guercio's excellent work.

Some experiments were made during the past season in combating this grape fruit moth. Some vineyardists found they could pick off the conspicuous, infested, green fruits for about $2 per acre. This is, of course, a very effectual method. Some vineyards were sprayed with arsenate of lead (10 pounds to 100 gallons) twice, just before blossoming and again when the fruit was about the size of grape seeds. The vineyardists state that these sprayings gave almost absolute protection to the crop. The point is to poison the early brood of larvæ that feed externally on the blossoms and very small fruits.

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[a] Nuove Relazioni R. Stazione di Entomologia Agraria, Serie Prima No. 1, pp. 118–193, by G. del Guercio.

We found that many of the larvæ of this grape pest were killed by a Braconid parasite (*Bracon scutator*).

Continuing the discussion, Mr. Webster gave some of the results of the experiments which he had made for controlling the grape root worm in Ohio. He expressed the opinion that as this species was subterranean in its habits during the larval stage, great care was necessary in drawing conclusions concerning any experiments for its control, he himself having been frequently disappointed.

Mr. Felt stated that he had seen considerable spraying with arsenical poisons for destroying this pest, and in these instances, as well as in his own experience, the measure had proved unsatisfactory. He cited a case where two vineyards had been carefully investigated; one was sprayed and the other was not. At the close of the season there were relatively more grubs about the sprayed than the unsprayed vines, and he has yet to find a vineyard where satisfactory results followed this treatment. His experiments showed that if pupæ were killed by cultivation at the proper time, and the beetles collected and destroyed at intervals of five days, so long as they were abundant enough to warrant this measure, the numbers of the pest were very greatly decreased.

MORNING SESSION, THURSDAY, DECEMBER 31, 1903—9 A. M.

The meeting was called to order by Mr. Washburn. Letters were read by the secretary from Miss Murtfeldt, Mr. Skinner, and Mr. Smith, expressing regret that they were unable to be present at the meetings. A letter was also read from Prof. William Trelease, containing an invitation to the members of the Association to visit the Missouri Botanical Gardens, which was unanimously accepted.

The following paper was presented:

NOTES OF THE YEAR FROM COLORADO.

By C. P. Gillette, *Fort Collins, Colo.*

[Withdrawn for publication elsewhere.]

Mr. Gillette exhibited a collection containing some of the insects discussed in his paper, and stated that the wheat-stem maggot that he referred to attacks the stems of the wheat plant.

Mr. Fletcher suggested that this insect be called the Colorado wheat-stem maggot, to distinguish it from *Meromyza americana*, which is widely known as the wheat-stem maggot.

Mr. Snow reported that he had taken *Nysius californicus* abundantly in the San Francisco Mountains, near Flagstaff, Ariz., at an elevation of 12,800 feet above the sea level, and that no vegetation was present at that point.

Mr. Osborn thought that *Pentatoma sayi* must occur on some native plant, but had evidently adapted itself to cultivated plants, and suggested that it might spread in the same manner as the potato beetle.

Mr. Washburn referred to having found this species on wheat last summer, but did not consider it a serious grain pest.

Mr. Wilcox spoke of a method of catching grasshoppers which he had seen practiced in the West, which was known as "ballooning." A large sack was tied with a rope in such a manner as to keep the mouth of the sack open. The other end of the rope was attached to the pommel of a saddle, and as the horse was driven rapidly across the field large quantities of the insects were caught. He stated that where a bounty of 1 cent a pound was paid for the insects a man could make from $5 to $10 a day by using the "balloon."

Mr. Gillette stated that the short-winged forms of *Melanoplus bivittatus* and *M. femur-rubrum* were not common, and that the specimens that he was showing were mostly taken by Mr. E. D. Ball in shady places, especially among some small trees at Fort Collins.

The following paper was then read:

SOME INJURIOUS INSECTS OF 1903 IN ONTARIO.

By William Lochhead, *Guelph, Ontario, Canada.*

Ontario occupies a unique position in many respects. The great agricultural part of the Province lies between the three Great Lakes, Huron, Erie, and Ontario, while to the north lies another large basin of water, the Georgian Bay. That these large bodies of water exercise an influence on plant and animal life is apparent to anyone who has looked into this question. For example, the plant life along the north shore of Lake Erie is fully two weeks in advance of the plant life near the center of the peninsula—say in the vicinity of Guelph. In that district peaches and grapes can be grown very successfully. Again, fully 200 miles north of Lake Erie is the Georgian Bay. On the south shore of this body of water is an attractive country which is excellently adapted for fruit growing. There peaches and grapes can also be grown without danger from frost. All through the central part of the peninsula grapes and peaches can not be grown successfully.

It is evident, therefore, that climate must exert a strong influence on both plant and animal life, and it is the duty of the economic entomologist to find out the amount of this influence. During the seasons of 1899, 1900, and 1901 the Hessian fly and pea weevil were very prevalent in the southwestern part of Ontario, but through some unknown cause these pests have to some extent largely disappeared. Believing that it would be possible to determine some of these unknown causes, the Ontario Agricultural College has decided to establish small meteorological stations in the various sections of the Province in order to obtain reliable data regarding the temperature and precipitation throughout the year. It is thought that in time some information of value may be obtained based on these observations.

As I have already noted, the Hessian fly is no longer a serious pest in Ontario, for it has been observed in one or two localities only during the past season. When we remember that in the years 1900 and 1901 the annual loss from this insect alone in Ontario was at least two and a half millions of dollars, we can realize to some extent the relief which the farmers feel on the disappearance of this fly.

The pea weevil, which was so disastrous last season, has not been so active in 1903. There is no doubt that weevils are present in large numbers, but the farmers are now well acquainted with the best methods of dealing with this pest. Some districts have discontinued the growing of peas altogether and provided substitute crops. In other districts fumigation with carbon bisulphid is largely practiced, and farmers are careful to fumigate all their seed peas.

Ontario sells more than $2,000,000 worth of clover seed, and a reliable buyer told me that not less than one-fourth of the crop had been ruined this year. In some districts the entire crop was destroyed. That the clover-seed midge is the chief cause of the destruction an examination of the infested fields in June clearly showed, but there are other insects working with the midge. The clover thrips was very abundant in many parts, and I am inclined to believe that some of the loss must be attributed to this pest.

The Grimsby-Burlington district, at the head of Lake Ontario, has suffered severely for many years from the effects of the pear psylla. Last season the injury was very perceptible, and many of the orchardists consider the outlook decidedly gloomy for the coming season. The recent experiments against San Jose scale have taught many the value of early spraying with crude petroleum, whale-oil soap solution, or lime-sulphur salt mixture. The orchards which were the most effectively treated for the San Jose scale suffered least from the effects of the psylla.

For the first time in many years the Grimsby-Burlington district suffered severely from the apple aphis. Previous to this year it was a rare insect, but the injuries done this past season have convinced the fruit growers that something must be done to control this aphis.

Among garden insects, while the common squash bug was not so abundant this year as usual, the cucumber beetles kept up their attacks as in previous years. The asparagus beetles are now passing through Ontario, but, strange to say, the twelve-spotted species is taking the lead. In the districts which have been infested for two or more seasons the common asparagus beetle is by far the more abundant.

With regard to the San Jose scale I regret to report that the insect was never more abundant than it is at present. The fruit growers are now in earnest regarding the matter of controlling the scale, but they have delayed too long. Hard, persistent work is now necessary to present marketable fruit, and much money will have to be expended in providing spraying materials. Our San Jose scale-infested area occupies only a small portion of the Province, and many of our finest fruit sections are still free from the pest. Our fumigation act is rigidly enforced, and it has undoubtedly been the chief means for the prevention of the spread of the scale.

In the southwest part of the province the lime-sulphur-salt remedy has been tried on an extensive scale, and it has been found effective and cheap. By the establishing of township sprayers better work has been done and at little trouble by the owners. The owner acts as general supervisor of the spraying operations and sees that the operation is done properly.

A little east of this section crude petroleum is the standard remedy. Oil wells are close by, and the orchards are almost altogether composed of apples, pears, and plums.

In the Niagara district, for some reason or other, the two remedies found effective farther west are not popular.

Mr. Felt remarked that in New York *Crioceris asparagi* was more injurious than *C. 12-punctata*, this being especially true in the Hudson Valley.

Mr. Lochhead stated, in answer to a question, that grapes were grown to a large extent in Ontario, but the grape fidia had not yet appeared.

Mr. Gillette reported that alfalfa was attacked by thrips in Colorado, the seed being ruined, and asked if any new remedies had been found for destroying the squash bug.

Mr. Felt replied that the shingle method, which had been used in Massachusetts years ago, was the most satisfactory one that he had tried.

Mr. Fletcher next presented a paper entitled—

INSECTS OF THE YEAR IN CANADA.

By Dr. James Fletcher, *Dominion Entomologist.*

The season of 1903 in Canada has presented some unusual characteristics in almost all parts of the Dominion. Until the middle of June an exceptional drought prevailed from the Great Lakes to the Atlantic coast. On the prairies spring conditions were most favorable, but a cool summer with a moist autumn delayed ripening of all crops. These conditions had a marked influence on the prevalence of insects. There were few outbreaks of cutworms and there was no complaint of widespread injury. The pea weevil, which has done so much harm in the pea-growing districts of the Province of Ontario, was decidedly less destructive than usual. This, I believe, was to a large measure due to a vigorous campaign instituted last year to induce farmers and seed merchants to adopt the well-known remedies and preventive measures of controlling this insect. The pea moth was hardly mentioned in correspondence, but occurred to some extent in the Maritime Provinces. Over the same area the carrot rust-fly was the cause of some damage, particularly to red carrots. The asparagus beetles, which are a somewhat recent introduction into Canada, occurred over a rather wider area in Ontario than in previous years, and have now spread east as far as Toronto.

Some of the important pests of the field, orchard, and garden were conspicuously absent last season. There was a marked decrease in the amount of injury by the Hessian fly. This insect was observed in one or two localities only in western Ontario, where for some years it has been the cause of excessive loss. A slight injury was reported from Manitoba and the northwest territories, as well as from Prince Edward Island. In the case of the northwestern records there is no doubt that there was some confusion with injuries both by the wheat-stem maggot (*Meromyza americana*) and the wheat-stem sawfly (*Cephus pygmaeus*). There was hardly a complaint of injury by the squash bug (*Anasa tristis* DeG.), and no mention whatever of the tent caterpillars. Even those two redoubtable enemies of the fruit grower the codling moth and the plum curculio failed to appear in sufficient numbers to draw attention. The codling moth in the eastern part of the Dominion, where there is only one brood, scarcely affected the crop at all, and west of Toronto, where there are two broods, it was only late in the season when any injury was noticeable. This exemption from injury is due undoubtedly, in a large measure, to the nature of the season, but has been contributed to by improved orchard methods, including systematic spraying by most of our best fruit growers. The double method of spraying in spring and banding with burlap in autumn have been recommended, and fruit growers have been reminded that the examination of these bands and the destruction of the contained larvæ is of even more importance than putting the bands on the trees. Stress was also laid upon the fact that more effective work could be done, looking to future exemption, by thorough and careful work in years of small occurrences than when the insects were enormously abundant. The plum curculio was locally the cause of severe injury in a few localities where spraying had been neglected, but the enormous crop of plums this year in all parts of Canada rendered the attacks of the plum curculio insignificant, if not an actual benefit. There is one subject I should like particularly to bring before the Association, which is spraying for the control of the plum curculio. In Canada spraying for this insect is a practical paying remedy, which I calculate will save 50 per cent of the crop, but I notice that United States writers seldom mention spraying, and pin their faith to the extremely expensive, troublesome, and, with me, comparatively ineffective method of jarring the trees. Last year I corresponded with some of those who recommended jarring, and was very much surprised to find how few had tried spraying and compared it as to efficiency and cost with jarring.

The eye-spotted bud-moth was abundant in Nova Scotia and caused some injury to the apple crop. Two insects which are noticeably on the increase in Canada are the fall webworm and the white-marked tussock moth. Fruit growers and municipal bodies have been reminded that these well-known insects are easily fought if the proper measures are adopted. The birch skeletonizer, *Bucculatrix canadensisella* Cham., appeared again in some numbers in central Ontario, but was not nearly such a pest as it has been for the past two years.

Among insects which have been the cause of considerable damage during the season of 1903, or have been unusually abundant, mention may be made of the following:

Plant-lice of all kinds have been very prevalent. The grain aphis extended from the Northwest Territories to the Atlantic coast, but compared with its great abundance affected very little the quality of the crop. The cabbage aphis was a serious enemy of early cabbages in British Columbia, and of turnips to some extent throughout the Dominion, but was the cause of more considerable loss in Prince Edward Island and Nova Scotia. The apple aphis appeared early in the season in enormous numbers in Ontario, Quebec, and Nova Scotia, but was less abundant than usual in British Columbia, where, as a rule, it is one of the most destructive enemies of the apple grower. The most important injuries by the apple aphis in 1903 were to young trees in nurseries and to the fruit while young and green. In some varieties more than others the fruit was much distorted and disfigured so as to give very much the appearance of apples which had been "stung" by the small British Columbian apple fruit-miner (*Argyresthia conjugella* Z.). The black-cherry aphis and the two plum aphides appeared in considerable numbers in central Canada and were the cause of some injury.

The clover-seed midge was one of the most destructive insects of the year and was the cause of enormous loss in the clover-seed-growing districts of western Ontario.

The sugar-beet webworm (*Loxostege sticticalis* L.) appeared in countless swarms in Manitoba in June and September, and was the cause of considerable alarm among farmers, who feared from the large number of different plants which the larvae attacked that they might develop into an enemy of the all-important wheat crop. Their depredations, however, were almost entirely confined to weeds or plants of no value. In the districts where this insect occurred there happened to be very few fields of either mangels or sugar beets. The most attractive plant was the common weed *Chenopodium album*, of which some fields were entirely cleared. In gardens spinach and beets suffered most.

In Manitoba some loss was caused by grasshoppers. The Criddle mixture was again experimented with, and very satisfactory results were obtained. After three years' practice Mr. Criddle now recommends that this mixture be made as follows: One part by measurement of Paris green to 120 parts horse droppings, preferably fresh, or about 1 pound of Paris green to half a coal-oil barrel of barn droppings. One pound of salt should be added when the droppings are not fresh. I again had the pleasure last summer when in Manitoba of seeing how effective this mixture is in destroying locusts. A field which had been protected by having the mixture scattered freely around the edges stood out as a green patch in a brown plain among fields where nothing had been done to kill the grasshoppers. The species of locusts concerned in this outbreak were the same as occurred in the locality last year, viz, *Melanoplus atlanis*, *M. spretus*, *M. bivittatus*, and *M. packardii*. They were abundantly accompanied by their parasites, the red locust mite and the blister beetles, *Epicauta sericans* and *E. pennsylvanica*. Through the kindness of Doctor Howard I was able to try some experiments upon this swarm with the locust fungus, of which he provided me with six test tubes of a fresh culture. These were very carefully manipulated by Mr. Norman Criddle throughout the season, but no appreciable results could be detected, an outcome which I learn has been similar to those of all other experimenters who have tried this at first sight attractive but really disappointing method of killing locusts.

The pear-tree flea-louse (*Psylla pyricola* Foerster) occurs to some extent in many Canadian orchards and has in a few instances caused considerable loss. During the past season specimens were received from as far east as Nova Scotia. A remedy which has been much cited is one which has been used by Mr. Henry Lutz, of Youngstown, N. Y. This consists of scraping the trunks of the trees in cold weather, burning the scrapings, and then giving them a thorough coating of slushy whitewash. I shall be glad if any members present who have tested this remedy will give us the benefit of their experience, as I know that this enemy of the pear is attracting a good deal of attention in the Eastern States.

The San Jose scale in Canada, I am thankful to say, has not spread beyond the limits of the area which was known to be infested at the time of our last meeting, but nevertheless its numbers have decidedly increased within that area. The injury now being done, it must be acknowledged, is extreme. This area is comparatively small and lies south of a line drawn from the extreme western end of Lake Ontario to Lake St. Clair. The Federal Government is watching most jealously every shrub and tree imported from countries known to be infested, and all classes of plants upon which the scale is liable to be introduced are fumigated at the border by Government officials, whether this is stated to have been previously done or not. It is but just to state that up to the present time not a single instance has been found of new infestation from stock brought into the country, or of a living scale upon any tree which had been fumigated. Those progressive fruit growers who have sprayed their trees to clear them of the San Jose scale have had the greatest satisfaction with the lime, sulphur, and salt wash, either with or without the salt. Experiments are in progress with the New York Geneva station lime and sulphur wash, in which the sulphur is combined with the lime by mixing it, while the latter is being slaked, with a solution of caustic soda or caustic potash. If this combination should prove stable and effective, it will, I believe, be found to be one of the most important discoveries in economic entomology. The one great difficulty in the way of getting this useful remedy against scale insects adopted is the trouble and inconvenience of boiling it from two to three hours to dissolve the sulphur. I regret to say that my own experiments with this wash, like those of all other workers I have so far corresponded with, are incomplete. I have found that the combination of the sulphur with the lime can be brought about quickly and without difficulty, but as yet I do not know how effective the wash thus made is upon the scale insects. I hope at this meeting to get some further light upon this important subject.

Root maggots of the cabbage, turnip, radish, and onion were very destructive in many parts of Canada during the past season, complaints of their depredations having been received from both the Atlantic and Pacific coasts, as well as from many points in the interior. Satisfactory remedies for these insects seem still to be desiderata. For cabbages and cauliflowers, in my experience, the best remedy has been the use of the tarred-paper disks recommended by Professor Slingerland. Next to these is the pouring of a small quantity of a strong decoction of pyrethrum insect powder (4 ounces to the gallon of water) around the root of each plant, after drawing away the earth; the earth then to be replaced. For onions and radishes, dusting white hellebore along the rows as soon as the young plants appear has given good results. For garden radishes and onions undoubtedly the best application is Prof. A. J. Cook's carbolic wash, made by adding 1 quart of soft soap or 1 pound of hard soap to a gallon of water, heat to the boiling point, and add crude carbolic acid half a pint. When required for use take one part of the stock mixture to fifty of water and sprinkle directly upon the growing plants once a week from the time they appear above the ground.

Some very satisfactory experiments from the entomologist's standpoint were made during the past summer by Mr. W. T. Macoun, the horticulturist of the Central Experimental Farm. Several varieties of tobacco and vegetables were grown beneath a cheese-cloth inclosure, so as to improve the quality of the plants, and it was observed that not only were satisfactory results obtained with the plants, but that this cheap protection prevented entirely the attacks of many kinds of injurious insects. Radishes, onions, cabbages, and cauliflowers were well developed and absolutely free from root maggots. Nothing was attacked by either the tarnished or four-lined leaf bugs, or by the turnip flea beetle. Cucurbits of all kinds were free from attack by the striped cucumber beetle; in fact, this experiment has shown that at small expense choice vegetables can be grown, the cultivation of some of which had been relinquished by gardeners, owing to the difficulty of producing them free of insect injury. The plan of applying this preventive method will, of course, vary with circumstances, but I believe that a light frame covered with cheese cloth will form an easy means for entomologists to protect plants against some insects which now defy our efforts. There is not, of course, anything new in the idea except the extent to which the protection was applied.

An insect which of recent years has given very little trouble in Canada is the hop aphis. During 1903 hop yards in southern central Ontario were badly attacked and much loss was sustained. Where the quassia and soap wash was applied much benefit was manifest, and hop growers claim that the results paid them well for all expenditure of time and labor.

The hornfly, which some years ago was the cause of so much loss on dairy and stock farms, was last year decidedly more troublesome than it had been for several years. This was probably due to the moist season, which kept cattle droppings in a condition suitable for the development of the larvæ for a much longer time than usual. I was interested at finding specimens of this fly upon horses at Regina, in the center of our Canadian northwest prairie region. I also observed that during the summer of 1903 it had reached the Pacific coast in British Columbia and was injuriously abundant on Vancouver Island.

Mr. Sanderson reported that creoline can be used to destroy fleas on domestic animals.

Mr. Summers stated that thrips had been found destroying carnations in greenhouses; also that he had found that burning sulphur in a house was satisfactory for clearing it of bedbugs.

Mr. Fletcher stated that in making the bran mash for destroying cutworms he mixed only enough Paris green with the bran to make it perceptibly green.

Referring to the best treatment for grasshoppers, Mr. Gillette remarked that the Criddle mixture of horse droppings, salt, and Paris green had not been very effective in Colorado during the past year.

Mr. Fletcher had found this mixture remarkably effective in Manitoba.

Mr. Wilcox cited the fact that at a recent meeting of the Public Health Association in Washington, D. C., a discussion arose as to the value of using hydrocyanic-acid gas for destroying bedbugs. It seemed to be the opinion of the meeting that this was a rather dangerous remedy, but very effective.

Mr. Felt remarked that he has used a full-strength charge for fleas in Albany, N. Y., and had accomplished good results. He thought it well to recommend iron bedsteads for use in houses where bedbugs are present. During recent years a thrips had injured onions and lettuce in New York, and *Corythuca irrorata* had caused much injury to chrysanthemums. It is probable that this insect usually lives on weeds. One grower sprayed with a mixture of whale-oil soap, using 1 pound of soap to 9 gallons of water, and reported good results.

Mr. Osborn believed that it was now recognized that the thripidæ were, on the whole, destructive and not carnivorous. A few years ago, when he made a statement to this effect, it was not generally accepted, but subsequent observations seemed to show that his previous statement was correct. The results of some studies made in 1881 showed that these insects had injured 80 per cent of the apple blossoms under observation, in all cases the pistils having been eaten. They also injure clover, and have been found working on strawberries in Illinois. This year plants in greenhouses in Columbus, Ohio, had been badly attacked by these pests.

Mr. Felt stated that he was able to kill fleas with one fumigation. In Mr. Summer's experience a fumigation, using a double strength, had been effective against these insects, but he had obtained satisfactory results by burning sulphur. He considered that great care should be taken to allow a room that has been fumigated with hydrocyanic-acid gas to air thoroughly before entering it, as some persons were able to stand only a small amount of the fumes.

Mr. Fletcher remarked that the sulphur fumes would probably be more effective to fleas and their larvæ if the floors were wet at the time the fumigation was done. Mr. Felt stated his belief that sulphur fumes might injure carpets, and added that he had fumigated successfully with hydrocyanic-acid gas without removing the carpets.

An abstract of the following paper was then presented:

OBSERVATIONS ON SOME OF THE INSECTS OF THE SEASON IN OHIO.

By HERBERT OSBORN, *Columbus, Ohio.*

The season of 1903 may be considered as somewhat uneventful entomologically for the State of Ohio, as there has been no unusual outbreak of the insects that are commonly destructive.

Of course there have been the usual abundance of grasshoppers and other forms which are almost universally present, but their abundance has not been sufficient to attract particular attention. On the other hand, insects have been noted which have more or less importance from the economic standpoint, and a few notes devoted to these may serve to indicate the nature of the season and also to continue the annual record which it seems desirable to maintain for each State.

The fall webworm (*Hyphantria cunea*), while not apparently very abundant over the State, at least not so numerous as a year or two ago, was quite abundant on the native forest trees and shrubbery of Cedar Point, near Sandusky. Here it occurs under practically native conditions, there having been no particular changes in the plants available for their attack and any marked modifications due to settlement or cultivation. The increase of the species, therefore, which seemed quite marked as contrasted with the previous year, may be considered simply as a natural increase due to some change in the abundance of the parasites or other favoring influences. While a number of bushes and small trees were badly eaten, in some cases completely defoliated, the damage will in all probability be repaired in another season's growth and probably none of the plants killed.

The apple maggot (*Trypeta* [*Rhagoletis*] *pomonella*) has been evidenced quite extensively by injured fruit which comes into the market in Columbus. Whether this is local or not I am unprepared to say, although most of the fruit so injured has been in market in such manner that it may have come from outside localities. Professor Hine has observed the work of this insect in apples which have come from the northwestern part of the State, and hence for that part of the State its presence may be recorded. The damage done by this species is often but slightly appreciated, at least until the fruit is used. The skin in many instances shows little evidence of their presence, and it is only in the rotting spaces or the pithy spots within the pulp and beneath the skin that its injury is apparent. Of course the keeping qualities of the fruit are greatly injured, as well as the qualities for table use.

Cankerworms were present in the early season in considerable numbers and a considerable proportion of the injury was due to the fall cankerworm.

The San Jose scale has of course attracted no little attention and its spread in the State has been marked by serious loss, but this species will doubtless be mentioned in detail by our secretary, whose duties have brought him into special connection with it.

During the latter part of August and in September I found on a species of Euphorbia, which occurs as a somewhat common weed on the university campus, considerable numbers of the little capsid, *Eccritotarsus elegans*, in both larval and adult forms, and was therefore able to secure the different stages in the life history of the species, with the exception of the egg.

It appears that the development is quite rapid, since the larvæ of different stages occur at the same time upon the same plants, and these, when kept in confinement, moulted frequently and attained their maturity in a short period of time. The species seems ordinarily quite rare, but this rarity in collections is doubtless due to its limitations in food plants, and perhaps also due to the limited period during which it occurs each season. It appears to coincide with the development of the blossoms in its host plant, and both young and adults match the color of the buds and portions of the leaves so closely that they are doubtless well protected by the mimicry. The young have the distinct purple-red color which agrees perfectly with the unopened buds, or, in some cases, with the parts of the leaves, the adults, with their white markings, with the seed pods after the dropping of the petals.

At the same time and on the same host plant there were found large numbers of one of the Coreid bugs, *Corizus hyalinus*, which in its development, and especially in the coloration and marking of the larvæ, shows a distinct adaptation to life upon this host.

One other species of considerable interest observed for the first time this year is a Fulgorid, which shows a rather anomalous habit of living underground and feeding upon the roots of various plants. This I have named *Myndus radiciis* and described in a recent number of the Ohio Naturalist (Vol. IV, p. 42). It was first noticed in the larval stage, occurring upon roots of Impatiens, nettles, and various species of grasses. Within a few days I secured by rearing several of the adults and about the same time these were found also in the ground, occurring in the cavities tenanted by the nymphs. The nymphs are of a pale greenish color, the sutural bands of the abdomen appearing white, and there is a prominent cottony tuft secreted on the posterior segment, which, when fully developed, extends one-third of the length of the abdomen beyond its apex. Two nymphal stages were observed, the younger having a length of 2.6^{mm} and a width of 1^{mm}. The mature nymph or pupa, as determined by rearing, has a length of 4^{mm}, or, including the cottony secretion, 4.5^{mm}, and a width of 1.2^{mm}. This stage is somewhat paler than the preceding, being pale yellow or whitish, some individuals being dusky, or in some cases somewhat darker green. In all cases they show the effect of the subterranean habit, although not totally devoid of the green color which may be associated with existence on foliage. In this respect they are pretty nearly parallel with some of the species of plant-lice which have adopted the subterranean habit. There is a well-marked stripe along the middle of the dorsal and fainter lines laterally marking the borders of the wing pads. The cottony tuft is very easily broken off, and until replaced is represented simply by white borders for the terminal abdominal segment. In no case have the nymphs been found on the foliage of plants, but always attached to the roots or in the cavities of earth, where they have access to the roots of their food plants. In some cases, however, where the roots were exposed on the surface, protected by drooping leaves of grass or by an accumulation of dead leaves or other rubbish, the larvæ were above ground, though under conditions similar to the underground cavities in which they most frequently occurred. The adults also were found in cavities beneath the ground and under leaves and rubbish at the surface, and they seemed quite closely confined to such locations. The wings, however, are well developed and they must be able to migrate without difficulty.

The economic importance of this species does not appear to be very great, as the plants affected are not of particular value, but the observation of a Fulgorid adapted to subterranean existence is of considerable economic interest, since it suggests the probability of other species in the same family, and particularly other members of the genus Myndus or of related genera, having a similar habit. Possibly these species occur in much greater numbers, and have a more important economic relation than we have suspected, since they are not often captured, and their work naturally goes unobserved.

The committee on nominations reported as follows:

For president, Prof. A. L. Quaintance, Washington, D. C.
For first vice-president, Mr. A. F. Burgess, Columbus, Ohio.
For second vice-president, Miss Mary E. Murtfeldt, Kirkwood, Mo.
For secretary-treasurer, Prof. H. E. Summers, Ames, Iowa.
For members of the council, Dr. Henry Skinner, Philadelphia, Pa.; Dr. James Fletcher, Ottawa, Ontario, Canada.

Respectfully submitted.

F. L. Washburn, *Chairman.*
C. P. Gillette.
E. P. Felt.

The report was accepted unanimously, and the above-mentioned officers were duly elected for the ensuing year.

The report of the committee on resolutions was next read, and is as follows:

Resolved by the Association of Economic Entomologists, That we appreciate most fully the past favors of the Department of Agriculture in publishing the proceedings of the Association, and respectfully request that the proceedings of the present meeting be published as heretofore.

Resolved, That the thanks of the Association be tendered to the board of education for the courtesy extended in the use of their building and for the excellent luncheon provided.

Resolved, That our thanks be extended to the local committee of arrangements for their successful efforts in behalf of the meeting.

Resolved, That we appreciate and do hereby tender our thanks to the Commissioners of the Louisiana Purchase Exposition for the invitation extended to the members of this Association to visit the grounds of the exposition.

Resolved, That our thanks are due and are hereby extended to the University Club for their courtesy in entertaining members of the Association.

Resolved, That our thanks be expressed to Dr. William Trelease, director Missouri Botanical Gardens, for his most cordial invitation to the members of the Association to visit the gardens.

Resolved, That we hereby acknowledge our indebtedness to the various members of the Association who have contributed so largely, by their papers, to the success of the meeting.

Respectfully submitted.

THOMAS B. SYMONS, *Chairman.*
WILLIAM LOCHHEAD.
E. DWIGHT SANDERSON.

By vote of the Association this report was accepted and adopted, as was the report of the treasurer and auditing committee, which follows:

REPORT OF THE TREASURER FOR 1903.

Balance on hand March 12, 1903		$5.57
EXPENDITURES.		
Printing announcements and programmes	$3.75	
Postage on announcements, programmes, and correspondence	3.50	
Envelopes for mailing announcements and programmes	.55	
		7.80
Deficit		2.23

Respectfully submitted.

A. F. BURGESS, *Treasurer.*

ST. LOUIS, MO., *December 30, 1903.*

We have examined the report of the treasurer, above given in full, and find it correct.

Respectfully submitted.

JAMES S. HINE.
CHARLES A. HART.
Auditing Committee.

The committee on membership submitted the following recommendations:

For active members: Mr. George H. French, Carbondale, Ill.; Mr. P. J. Parrott, Geneva, N. Y.; Mr. A. W. Morrill, Victoria, Tex.

To be changed from associate to active members: Miss Mary E. Murtfeldt, Kirkwood, Mo.; Mr. F. H. Snow, Lawrence, Kans.; Mr. T. B. Symons, Collegepark, Md.

For associate members: Mr. Otto H. Swezey, Columbus, Ohio; Mr. S. A. Johnson, Fort Collins, Colo.; Mr. F. C. Bishopp, Collegepark, Md.; Mr. Douglas B. Young, Albany, N. Y.; Mr. E. C. Green, College Station, Tex.; Mr. E. P. Taylor, Champaign, Ill.

The committee further recommend the adoption of the by-law relative to membership, which was presented at the meeting at Pittsburg in June, 1902.

Respectfully submitted.

HERBERT OSBORN, *Chairman.*
F. M. WEBSTER.
E. P. FELT.

By vote of the Association the list of names presented for membership was accepted as reported by the committee.

The by-law referred to in the report is as follows:

It shall be the duty of the officers of the Association, each year previous to the annual meeting, to carefully examine the list of members and recommend to the Association the dropping of such names as have in their opinion no further place upon our roll, such recommendations to be acted upon by the Association, and a vote of two-thirds of the members present to be sufficient to drop any name.

That in the interpretation of the paragraph of the constitution regarding the election of new members it be understood that an "economic entomologist" is a person who has been trained in entomological work and whose known work or published papers show him to be capable of conducting original work in economic entomology.

That the term "practical entomologist," referring to associate members, be held to indicate persons who have done general work in entomology and who have, by published papers or otherwise, given evidence of their attainments in such work.

That associate members be listed separately in the published roll, or the fact that they are associate members be indicated in the list.

After some discussion it was voted to adopt the first paragraph of the suggested by-law, and the remaining paragraphs were laid on the table until the next annual meeting.

Mr. Sanderson next read a paper entitled—

INSECTS OF 1903 IN TEXAS.

By E. DWIGHT SANDERSON, *College Station, Tex.*

Entomological problems in Texas are many and varied. Many pests are brought to our attention which have been comparatively unknown to entomological records heretofore.

GRAIN INSECTS.

The southern grain louse (*Toxoptera graminum* Rond.), made its appearance on wheat and oats in parts of north Texas early in March, but was soon destroyed by parasites. The winged aphis evidently migrates to the grain in the fall, as the injury commences in spots here and there over the field, and previous to the outbreak of 1901 these spots were observed as early as December, 1900. It seems probable that the pest is held in control by hymenopterous parasites whose reproduction is prevented by continued cold, wet weather, as Professor Webster has shown is the case with the nearly allied grain Nectarophora. The early spring of 1901 was unusually cold, wet, and backward in the injured territory. The aphides disappeared from the fields early in April, 1903, as in 1901. Evidently they migrate to some other host plant. They were reared in the laboratory until June 1 without any change of form or habit being indicated.

Specimens of *Nectarophora cerealis*[a] were secured early in January and reared until late April. Late in April apterous oviparous females and winged males appeared, and eggs were laid on the stalks of grain in the tubes. I was unable to secure the hatching of any of these eggs, or to find them in the field. This species becomes rare on small grains after early June, when they commence to head. It evidently must migrate to some other plant, upon which it probably lays an egg, as I have been unable to find any record of the egg.

Aphis avenæ Fab. (?)—Specimens determined by Mr. Th. Pergande as this species were found on small grains early in January commonly throughout the grain belt of the State and sometimes in considerable numbers. Several generations were reared up to June 1. This species remains near the surface of the soil, largely at the bases of the leaves. In May it was found on the roots of Johnson grass, and it was often found on the crown of a grain plant. The specimens I have do not agree with the description of Fabricius, but are given under this species upon Mr. Pergande's authority.

Aphis maidis Fitch was received upon barley which it had damaged in January and May. I have not noticed it on any other small grain. In August it becomes abundant on corn and later on sorghum, sometimes doing considerable damage.

The chinch bug (*Blissus leucopterus*) has been the most serious insect pest of corn in Oklahoma and north Texas for many years. In 1901 and 1902 drought and chinch bugs caused a practically total failure of the corn crop in the larger part of north Texas. This year the bugs appeared in large numbers upon the corn as soon as it appeared above ground, but, owing to a good rainfall through the spring, did not do general injury. Here and there injury by the second brood was reported to us. College Station is the southernmost point where we observed injury which was due to the first brood in May. The habits of this pest are somewhat different from what they are farther north, and it is therefore more difficult to combat. Where small grains are grown in winter it migrates from them to the corn early in June as elsewhere, and most injury is then due to the second brood, in June or early July. But where no small grains are grown the bugs emerge from winter quarters by the middle of April and assemble on the young corn in large numbers as soon as it is out of the soil. At this time the air is often full of them. On May 8 from 20 to 50 adult bugs and 5 to 15 newly hatched nymphs were to be found on each hill of corn at the college. The first brood of adult bugs commenced to appear about the middle of June. The second brood was found the first week of August, and a third brood is found about the middle of September, mostly on sorghum. Wherever sorghum stubble is left on the land over winter injury is worse the next season, as the bugs breed on it late in the fall and hibernate in the stubble. It has been found that the bugs seem to prefer millet and sorghum to corn in early spring, and we are now planning experiments to use these as trap crops for the protection of the corn.

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[a] I am unable to determine whether this is *N. cerealis* Kalt. or *N. granaria* Kby. Mr. Pergande informs me that he will shortly publish a paper in which these characters will be defined. Up to this time the two names seem to have been used synonymously by American writers.

Thyanta perditor Fab. was sent me from several points in north Texas during the summer months, with reports that it occurred in extraordinary numbers and had seriously injured oats, corn, and sorghum, and was also in milo maize and cowpeas. The habits of the pest seem to be very similar to those of *Lioderma uhleri* Stal, described by Prof. D. A. Saunders in South Dakota in 1898,[a] for which insect we first mistook it. Its identity was kindly determined by Dr. H. T. Fernald. It occurs commonly in central and north Texas on various crops.

The larva of *Diabrotica 12-punctata* caused the replanting of corn in a number of instances in central Texas.

COTTON PESTS.

The cotton square borer (*Uranotes melinus* Hubn.).—The larva of this dainty butterfly has been a serious pest of cotton for many years, as well as that of *Calycopis cecrops* Fab. (*Thecla poeas* Hubn.) This season the former species has been the more common observed by us. The principal injury occurs in June by the larvæ of the first brood boring into and hollowing out the young squares. One larva will go from square to square, thus soon stripping a plant, and often boring into the stalk. Fortunately these larvæ were severely parasitized, it being difficult to secure an unparasitized pupa, and no injury was reported after June. We are informed that in some localities this insect has been injurious for some years, while elsewhere this seems to have been the first season in which it has been noticed. It is a common pest of cowpeas and other legumes.

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[a] So. Dak. Agr. Exp. Sta. Bul., p. 57.

The white-lined morning sphinx (*Deilephila lineata* Fab.) always does more or less damage to young cotton in weedy fields. This year these larvæ appeared in extraordinary numbers near San Antonio and destroyed not only cotton but all sorts of garden truck.

The garden webworm (*Loxostege similalis* Guen.) did serious injury to young cotton in southwest and north Texas and Oklahoma, causing replanting in many instances. The common name "careless worm" used by the planters is peculiarly applicable to this pest, as it increases and becomes injurious only where the careless weeds (*Amaranthus* spp.) are allowed to grow, and can easily be controlled by spraying or dusting.

In southwest Texas the large lubber grasshopper (*Brachypeplus magnus*) usually destroys a considerable amount of cotton. The hoppers occur in large numbers and go through a field, cutting off all the cotton in their path.

Likewise *Lachnosterna lanceolata* Say often occurs in large swarms and cuts off the young plants on considerable areas.

PECAN INSECTS.

The growing of pecans is becoming a very profitable industry in Texas, though its development has only commenced.

The worst pest yet brought to my attention is the pecan husk worm (*Acrobasis caryæ* Grote). The larvæ bore into the young pecans, hollowing them out and causing them to drop to the ground. Later they riddle the husk and channel the surface of the nut. This species occurs on pecans where they grow in Texas, and, according to Doctor Dyar, in Illinois, Massachusetts, and New York. It is reported to sometimes almost totally destroy the crop in localities and to do serious injury generally in west central Texas, the chief pecan section. Usually injury is most between May 20 and June 10. This year the pest did comparatively little damage and no moths emerged until July 9. This was largely due to hymenopterous parasites. No means of practical control have yet been ascertained.

Phylloxera sp. has been sent me as injurious to pecan foliage near Galveston, and I find it common on the campus at the college.

The fall webworm is frequently injurious to pecan trees and this season did much damage to fruit trees in south Texas. A similar webworm, but of uniform brown color, which we have not determined, but either another species of Hyphantria or a variety of the above, seems to be peculiarly a pecan insect.

May 15 I received specimens of the pea louse (*Nectarophora pisi* Kalt.) from Dallas, and May 27 I found that they had destroyed a garden patch of peas on the Brazos River, near Wellborn, Tex. It would seem probable, therefore, that this is a general pest of peas in Texas, as Professor Quaintance has also observed it near Victoria.

The southern leaf-footed plant-bug (*Leptoglossus phyllopus*) is one of the worst pests of ripe plums and peaches, and this year was frequently reported injuring tomatoes by sucking the fruit.

The striped blister beetle (*Epicauta vittata*) is also a common pest of tomatoes and alfalfa.

A new tomato pest, determined for me by Prof. E. D. Ball, is *Stictocephala rotundata* Stal. The adult insects puncture the stems of the young plants, causing them to wilt. No nymphs were reported found on tomatoes in the fields. In the breeding cage eggs were laid in the base of the stem in pairs, much like those of the buffalo tree-hopper. The nymphs did not seem to thrive on tomato, however, all dying shortly. This is probably a synonym of *S. festina*, and, if so, has been previously recorded on tomatoes in Georgia and in New Mexico on alfalfa.

A leaf-bug, *Dicyphus separatus* Uhl., nearly related to the suck-fly of tobacco, has been troublesome to tomatoes in the college greenhouse.

The chicken tick (*Argas americana*) is now to be found as far north as the Red River and is occasionally reported from localities where formerly unknown.

The sweet-potato weevil (*Cylas formicarius*) has been the cause of the practical abandonment of the growing of sweet potatoes, which were formerly a quite profitable crop, in counties in south Texas. It has now spread to Austin, where it has been known for four years, and near Marlin, where it was destructive for the first time this season. This is a southern or tropical insect, but it is quite cosmopolitan, occurring in India, China, Madagascar, and Jamaica, and may very possibly spread farther north. Boring from the stem into the root and working in stored sweet potatoes, it is a difficult pest to combat and easily spreads.

One of the principal pests of the plum is the aphis, hitherto undescribed though first recorded and figured by Mr. W. M. Scott at the thirteenth meeting of this Association.[a] As this is evidently a southern species, I propose to name it the southern plum aphis, and hope to publish a full description of the viviparous forms shortly. It undoubtedly oviposits on plum in the fall and in Texas migrates from it in early summer.

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[a] Bull. 31, Div. Ent., U. S. Dept. Agr., pp. 56–58, figs. 1 to 4.

This was followed by a paper by Mr. Symons on—

ENTOMOLOGICAL NOTES FOR THE YEAR IN MARYLAND.

By T. B. Symons, *Collegepark, Md.*

The past year has not been marked by any unusual outbreaks of injurious insects, except in the case of a few species, which will be cited briefly. The usual depredations by the San Jose scale have occurred, and which, it may be said, is being controlled in a marked degree in many sections of the State by the use of the lime, sulphur, and salt wash.

Many complaints were received in the spring from the damage done to apple foliage by the "apple aphis" (*Aphis* spp.), and it was necessary to recommend several washes for their control. "Rose Leaf," one part to forty parts of water; 15 per cent kerosene emulsion, and whale-oil soap, one pound to the gallon of water, were the washes suggested.

The strawberry weevil (*Anthonomus signatus* Say) likewise did considerable damage to strawberries in the State. This injury was especially severe this year from the fact that a large number of the early blooms were killed by frost, which left a smaller percentage for the needs of the weevil, reducing the crop in some instances one-fourth of the average one.

Early in May and, in fact, throughout the summer months the ravages of the fruit-tree bark-beetle (*Scolytus rugulosus* Ratz.) were apparent in many orchards in the State. May 13, at St. Margarets, we observed several hundred trees injured by the beetle. My attention was called to many instances where the beetles had attacked perfectly healthy trees of peach, plum, and cherry. While this insect commences its work on sickly or half-dead trees, there is no doubt but that the beetles have developed the habit of attacking perfectly healthy ones. There seem to be no better remedies than to destroy the infested trees and the preventive measures of keeping dead wood cut out of the orchard and carefully burning all the brush.

The apple-tree tent caterpillar (*Clisiocampa* [*Malacosoma*] *americana*) was present in unusually large numbers during the early spring, but was practically controlled by burning and by the use of arsenical poisons, together with the unfavorable weather conditions.

There was locally a serious outbreak of the corn stalk-borer (*Diatræa saccharalis*), which attacked a field of corn in Kent County, damaging about 25 per cent of the cornstalks. This insect has not appeared in injurious numbers in Maryland since 1898, and it is peculiar to note its presence in such great numbers in two or three cornfields this year. Its injury consists in boring into the stalks of corn, thereby weakening them, and where several occur on a stalk it is so injured that it may fall down. There is practically nothing that can be done for this pest after it appears, and it is only left to ward against its reappearance the next season.

Injury was observed in a cornfield at Taylors Island from the stalk borer *Papaipema nitela*. This insect does its damage in a somewhat similar manner to that done by *Diatræa saccharalis*, except that after boring into the stem it tunnels its way upward, eating out the center of the plants.

Injury by the twelve-spotted diabrotica (*Diabrotica 12-punctata*) to young corn on the college farm was observed about the middle of May, but it did not later become serious.

The asparagus beetle (*Crioceris asparagi*) was a conspicuously injurious species the present year, and it is needless to say that an entirely satisfactory treatment for the pest has not yet been found.

The strawberry root-louse (*Aphis forbesi*) appears now to be generally distributed over the State, more so than in recent years, doing in some cases considerable damage. Likewise with this pest we are confronted with the fact that there is no satisfactory treatment, except rotation of crops and perhaps the burning over of the patches in early spring. It is the opinion of the writer, from observations up to this time, that in some localities in our State the aphides pass the winter on the roots of the plants, as I have found plants infested with the louse as late as December 12.

The melon aphis (*Aphis gossypii*) was conspicuous by its absence the past season, as in other years it has been a source of much apprehension on the part of the melon growers. From two or three complaints sent in the past season, one of the growers stated afterwards that he controlled the pest effectively by fumigating with carbon bisulphid.

Many complaints of the oyster-shell bark-louse (*Mytilaspis* (*Lepidosaphes ulmi*) *pomorum*) and the scurvy bark-louse (*Chionaspis furfurus*) were received during the year, and the latter is observed in nearly every orchard that is inspected.

The cigarette beetle (*Lasioderma serricorne*) has given us a great deal of trouble in Maryland. It is the opinion of the writer that there are very few tobacco warehouses and factories which are free from the pest. Also, that it is increasing under cover—that is to say, few owners of tobacco-leaf warehouses have detected its presence in their stock. The majority of them keep on hand a large quantity of tobacco boxed up in cases, and seldom examine their tobacco to detect the insect. The loss occasioned by this insect does, however, not fall on the tobacco-leaf merchant, but on the manufacturer who takes it into his factory and attempts to work it. When this insect is once established in a tobacco factory it is very difficult to entirely eradicate it. The writer knows of one instance where the owner has expended about $1,000 and has only partially eradicated the pest, and has since been constantly on the outlook for another outbreak. In one instance a stock of 30,000 pounds of leaf tobacco had to be fumigated in order to destroy the insect. In this connection it may be said, from our experience in using the two gases, carbon bisulphid and hydrocyanic-acid gas, we find the latter in general to be more effective. But in using either in fumigating large quantities of tobacco done up in cases of 350 pounds, it is difficult for the gas to entirely penetrate the case. In my opinion, tobacco warehouses should be inspected by an entomologist, who should issue a certificate to show that the buildings are apparently free from this pest. In this way the manufacturer would be protected from serious loss in purchasing tobacco that is infested with the insect.

Mr. Sanderson stated that the best remedy that he had found for *Anthonomus signatus* was to burn over the strawberry beds.

Mr. Washburn next presented a paper entitled—

INSECTS OF THE YEAR IN MINNESOTA, WITH DATA ON THE NUMBER OF BROODS OF CECIDOMYIA DESTRUCTOR SAY.

By F. L. Washburn, *St. Anthony Park, Minn.*

Plant-lice of various kinds have been extremely numerous this year, notably a grain plant-louse which for a while caused serious alarm among the farmers. It may have been either *Nectarophora cerealis* or *N. granaria*. It was well taken care of by parasites.

Eggs of apple aphides hatched in April, but a cold snap with some snow and sleet killed the young lice.

Two strawberry insects did some damage, *Anthonomus signatus* Say, and *Corimelæna* sp.?

A wholesale grocer in St. Paul complained to this office of a troublesome mite on dried figs from California and dried apples from New York State in a storage warehouse. This proved to be, according to Banks, *Carpoglyphus passularum* Hering.

This year has seen numerous leaf-miners on oak trees, notably *Lithocolletis hamadryadella* Clem., which was extremely destructive on various kinds of oak, particularly white oak, in the vicinity of the twin cities, but was not observed in other parts of the State.

Specimens of *Tribolium confusum* were sent to the laboratory from an elevator, and while being used in some laboratory experiments a few escaped; we afterwards found one attacking a dried insect specimen in an imperfect insect box, not an unusual habit of this omnivorous pest.

A powder-post beetle (*Lyctus striatus* Melsh.)[a] is causing much concern to wholesale houses dealing with ax handles and wheel spokes, shafts, and the like.

This office is ready to indorse the borax remedy for cockroaches or croton bugs, having met with complete success with its use after trying without good results various other remedies.

Lachnosterna spp. has been extremely injurious this season, working not only on sod, but also on the roots of wheat and barley, and has been found by the writer killing, in nurseries, the Colorado blue spruce, a tree which brings nurserymen from $2 to $5 when 4 feet high. The species has been identified in some instances as *rugosa*, and other specimens are now in the breeding cage awaiting transformation. One nurseryman told the writer that he had lost some years ago through the agency of this genus every small evergreen tree except his cedars.

This has been a bad year for potato beetles, it being claimed that they have not been so numerous for a number of years.

The horn fly, as was to be expected, has been troublesome on cattle and other stock.

Of the leading pests of Minnesota—grasshoppers, the chinch bug, and Hessian fly—we have to report very little injury from the first, which in 1902 made themselves conspicuous in the northwestern corner of the State. I refer to the native form *Melanoplus atlanis*, which was quite destructive last year, but hardly heard from during the season just passed. This is undoubtedly in part due to the fact that a grasshopper law was passed by the legislature last winter obliging the owner or lessee of land declared infested with grasshopper eggs to plow said land. Farmers and others promptly took care of large tracts of land which had lain fallow for several years in the northwestern part of the State, the same being known to have been a frequent breeding ground of the pest previously. The few cases of injury reported this season could be traced directly to one or two plats of land which had not been plowed, the bill becoming a law too late to be effective in these cases this season. Weather conditions have done much to influence the work of the chinch bug, which, with the exception of Stearns and adjoining counties in the central part of the State, has not caused any special injury. But in the counties above mentioned, particularly in Stearns County, it has been more troublesome than for many years, farmers losing all the way from 10 to 50 per cent, and in some cases their entire crop of wheat.

The Hessian fly, now spread over our entire wheat-growing regions, was not serious in the northern part of the State, partly on account of extreme dryness in that portion during the spring and early summer, but one found its ravages more apparent upon coming south through the Red River Valley.

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[a] Now recognized as *Lyctus unipunctatus* Hbst., common to both continents.—F. H. C.

The number of broods of this pest varies of course with the season, depending on whether the season be dry and warm or moist and cool; nevertheless that the Hessian fly has normally more than one brood has been for some time such a firm conviction in the mind of the entomologist that this season a serious attempt was made to put the matter beyond doubt with gratifying results. It has seemed to the writer that the "flaxseeds" found in stubble in the autumn could hardly account for the immense injury done the crop the ensuing year, unless the fly was more than one-brooded.

Professor Lugger, our predecessor, always claimed but one brood in this latitude, and none of his reports indicate that he had changed his mind after making this statement. In one of the reports he said: "Not one fly issued from stalks gathered as soon as injury became visible. This assuredly seems to indicate that the flies do not issue during the autumn, as they do farther south, but remain in the culm until the spring." He further found no larvæ or puparia in volunteer wheat growing near fields that had been badly infested. We have found facts this season warranting us to take exceptions to the last two statements.

The following are in brief the results of this year's work in this direction. Although able to state them briefly, they represent an immense amount of work in examining plants.

On June 25 larvæ of Hessian fly in second stage were brought to the laboratory, and one fly (and it is to be noted, only one), a female, emerged July 19; she lived two days, depositing about 90 eggs on the green blade of wheat. July 1 one larva in first stage, found in field, brought to laboratory, but did not live. On second day larvæ in second stage were secured and placed in breeding jar; July 8 they developed puparia, and on August 16 one (and only one), a female, emerged. On October 18 puparia were found on volunteer wheat growing in the stubble after harvest in the northern part of the State. It would seem then that there is normally in Minnesota more than one brood of Hessian fly. The observations, however, of this season are not to be taken as criteria necessarily for every year.

Regarding the imagos emerging from puparia which wintered over as the first brood, the breeding experiments above outlined would indicate a second brood of adults July 19, approximately, and a third brood about the middle of August. But what I call the second brood may be supernumerary to the first or to the brood which I call the third. The plants upon which these observations were made were placed in moist sand, thereby seemingly securing favorable conditions for the development of the fly. Volunteer wheat plants growing in stubble or on the plowed land and along edges of fields, which have hitherto been disregarded as a possible source of the pest, now figure in a different light. From an economic standpoint we may say that although Minnesota may sometime raise more winter wheat than it does now, it being claimed that a yield may be obtained three years out of every five, as long as spring-sown wheat is practically the chief wheat crop, these facts have no decided bearing beyond that of showing the need of plowing under the volunteer wheat. We would naturally suppose, however, that puparia would be found in the fall upon the fall-sown rye, and that said rye would show injury the following spring. As a matter of fact no complaint whatever reaches us regarding injury to rye.

The little green leaf-hopper, *Empoasca mali* Walsh, must not be overlooked in an account of the year's insects. This pest has been extremely injurious in nurseries in southern Minnesota during the past season, affecting apple trees particularly and checking their growth to a marked degree, though found on other trees as well as on the apple.

In discussing this paper Mr. Fletcher stated that he was much interested in the number of broods of the Hessian fly in Minnesota. He thought that Mr. Washburn finding two broods was an exceptional occurrence. In Manitoba he had only been able to find a single brood.

The summer "flaxseeds" do not develop flies until the following spring, and as no fall wheat is grown it is only occasionally that there is rain enough to start volunteer wheat early enough for the eggs to be laid upon it. In case there were a second brood in Manitoba, the larvæ would have nothing to feed on, and although this insect has been recorded as feeding on timothy and wild grass in Russia this fact has never been observed in America. In his opinion the conditions under which the second brood was found in Minnesota were artificial, and he hoped that further observations concerning this point would be carried on.

Mr. Washburn called attention to the fact that he had found "flaxseeds" on volunteer wheat growing in stubble in October.

A motion was made and carried that the remaining papers, which had been sent to the meeting by members who were unable to be present, be read by title. These papers are as follows:

(1) Early Western Entomologists, by Mary E. Murtfeldt, Kirkwood, Mo.

(2) An Experiment with Black Flies, by C. M. Weed, Durham, N. H.

(3) The Brown-tail Moth in New Hampshire, by C. M. Weed, Durham, N. H.

(4) Some British Fruit-tree Pests Liable to be Introduced into America, by Frederick V. Theobald, Wyecourt, England.

(5) Insect Notes from Georgia for the Year 1903, by Wilmon Newell, Atlanta, Ga.

(6) Insect Notes from Connecticut, by W. E. Britton, New Haven, Conn.

Numbers 2, 3, 5, and 6 are published herewith; number 4 in Bulletin 44 of the present series.

INSECT NOTES FROM GEORGIA FOR THE YEAR 1903.

WILMON NEWELL, *Atlanta, Ga.*

As in previous years, the San Jose scale has been the most serious pest in Georgia and has received by far the most attention. Experiments conducted by W. M. Scott, former State entomologist, have shown the lime-sulphur-salt wash to be more effective and much safer than the treatments with crude oil and kerosene. As a result, these latter treatments have been for the most part abandoned by the commercial peach growers, and the great majority of scale-infested orchards in the State will the coming winter be sprayed with the lime-sulphur-salt. In many of the larger orchards outfits have been prepared for boiling the mixture by means of steam, these outfits in many cases using boilers of from 15 to 30 horsepower. Several modifications of the lime-sulphur-salt wash have been tested, but none have been found as effective as the regular formula of 30 pounds lime, 20 pounds sulphur, 15 pounds salt, and 60 gallons of water.

The colony of Asiatic lady beetles (*Chilocorus similis*) secured by Professor Scott from the Division of Entomology at Washington, D. C., in August, 1902, and introduced in a scale-infested orchard at Marshallville, Ga., has increased to a remarkable extent during the past season. A number of colonies have been sent to other parts of the State as well as to entomologists in other States. During the latter part of the summer their beneficial work could be plainly seen in the Marshallville orchard. They did not, however, become abundant enough to destroy the San Jose scale in proportion to the rapidity with which the latter bred, so that the possibility of their successfully controlling this pest is still a matter of conjecture. It was noted that this species hibernated much earlier than the native species. By October 16 very few adults and no larvæ or pupæ could be found upon the trees, while up to November 1 most native Coccinellids were plentiful.

Next to the San Jose scale, the peach borer (*Sanninoidea exitiosa*) is perhaps the most destructive insect pest occurring in the State. Very few peach orchards can be found in which these insects are not abundant. No effective remedy—aside from the tedious and expensive "worming"—is at hand, and the only chance of effectively reducing the numbers of this pest appears to be in the enforcement of stringent laws for bird protection.

The fruit-tree bark-beetle (*Scolytus rugulosus*), or "shot-hole borer," as it is more commonly called in the South, occurs generally in the peach orchards of the State, and while the damage is scattered, yet in the aggregate it amounts to considerable. Our observations upon this species in Georgia have not substantiated the popular idea that this pest attacks only trees which have been weakened from other causes. We have often found them working upon trees otherwise perfectly healthy so far as examination of the entire tree, roots and all, could determine. Wherever a badly infested tree is found in a peach orchard, the adjacent trees invariably show the work of this insect, indicating that they are by no means confined to diseased and dying trees.

The cotton caterpillar (*Aletia* [*Alabama*] *argillacea*) appeared in considerable numbers in fourteen counties of southwestern Georgia during August. Experiments were at once inaugurated against the pest at Montezuma, Ga., in which several strengths of both Paris green and arsenate of lead were tested, together with methods of applying them.

These experiments resulted in the adoption of a mixture of one part Paris green and five parts air-slaked lime, distributed from thin cotton sacks by laborers on foot. It was found that each laborer could in this way poison from 12 to 14 acres per day. The method, frequently recommended, of distributing Paris green from sacks attached to a pole and carried upon horseback, was found entirely impracticable, resulting in danger to both man and beast and making an equal distribution of the poison impossible, especially in a breeze or light wind. For showery or rainy weather arsenate of lead, used at the rate of 2 pounds to 50 gallons of water and applied with a knapsack or autopump, was found most satisfactory, although more expensive, as only about 4 or 5 acres per day could be covered by each hand.

Although both eggs and moths were abundant in the fields during the last week in August, the large brood of caterpillars expected to ensue during September did not appear. The weather during the first week of September, when the eggs were hatching, was exceptionally hot and dry, and it appears very probable that the small larvæ were killed by the extreme heat. Unfortunately, the pressure of nursery inspection work at this time prevented us from personally visiting the fields; but our view is materially strengthened by the fact that from several hundred Aletia pupæ reared to maturity in the laboratory but two parasites were secured.

During the early part of July the chinch bug (*Blissus leucopterus*)—an unusual insect in Georgia—appeared in the rice fields near Savannah and occasioned some little alarm. However, the remedy was already at hand, the rice fields were flooded, and nothing more was heard of the chinch bug.

April 25 specimens of the Hessian fly (*Cecidomyia destructor*) were received from Harmony Grove, Ga. This species has not been sufficiently abundant so that the egg-laying periods could be determined, although if obtainable they would furnish data for an interesting comparison with the habits of the insect farther north.

To prevent the possible introduction of the Mexican boll weevil (*Anthonomus grandis*) the Georgia State Board of Entomology has adopted and put in force a regulation prohibiting the importation of cotton seed from points in Texas or Louisiana unless such cotton seed is accompanied by a certificate, signed by a duly authorized State or Government entomologist, stating that it has been fumigated in such manner as to kill all adults, pupae, or larvae of the boll weevil that may be contained therein.

October 23 the writer found a number of pines dead and dying upon a ridge near Cornelia, Ga., which showed the work of a scolytid. The work was identified by Prof. A. D. Hopkins as that of *Dendroctonus frontalis*. So far as we are informed, this is the most southern point from which this destructive species has been reported. The outbreak at Cornelia is at present being investigated by Mr. W. F. Fiske, of the United States Division of Entomology.

Various insects of minor importance have appeared in greater or less numbers during the year.

INSECT NOTES FROM CONNECTICUT.

By W. E. BRITTON, *New Haven, Conn.*

Plant-lice have been extremely abundant the past season, and especially the green apple plant-louse (probably *Aphis pomi* DeG.), which caused much damage to nursery stock and young orchard trees. This pest attacks the leaves and stems of the new shoots, causing the leaves to curl and noticeably checking the growth. Most of the nursery stock this season is below the usual size on account of the injuries caused by this aphis. In one large nursery the tops of the trees were dipped in kerosene emulsion to kill the lice, but most nurserymen think that they can not afford to apply any form of treatment to growing nursery stock. The green pea louse (*Nectarophora pisi* Kalt.) was less abundant than during the preceding season, though many late peas were injured.

Pear trees were greatly injured by the pear psylla (*Psylla pyricola* Först.), which was unusually abundant, and many trees dropped their leaves completely during July and August. As this is a difficult insect to combat, very little is usually done by the fruit growers. We found, however, that a large proportion of the nymphs and some of the adults could be killed by a careful spraying, even in July, with soap and water (1 pound in 4 gallons).

Lady beetles of nearly all kinds were abundant during the season.

The San Jose scale insect has increased with great rapidity, and many trees that were very slightly infested in early summer are now completely incrusted. At the date of this writing (December 1) the young are still crawling, though we have had freezing weather for a week or more. The lime, sulphur, and salt mixture was used last winter on more than 10,000 trees in Connecticut, mostly in orchards, with very satisfactory results. It has been found that the time of boiling can be shortened somewhat and the quantity of lime lessened without impairing the effectiveness of the mixture. There is still a demand, however, for a mixture that can be prepared and applied easily without boiling. In a small way the potassium sulphide and lime mixture fulfills these requirements, but it is altogether too expensive for use on a large scale. The potassium sulphide is simply dissolved in water and the lime slaked in separate barrels, and when all lumps have disappeared put the two liquids together and sulphides of lime are formed. The proportions used in our experiments were 20 pounds potassium sulphide, 20 pounds lime to 40 gallons of water.

Eulecanium armeniacum Craw. is becoming quite common in Connecticut, and is found on a variety of trees. Not only fruit trees are attacked, but white ash trees from the woodlands of Windsor were quite badly infested, and it has been received on ash from West Cornwall. *E. tulipiferæ* Cook. occurs on Liriodendron, both native and on cultivated grounds. *Chionaspis pinifoliæ* Fitch has been found several times in various parts of the State on *Pinus strobus* and *P. mughus.*

Serious injury to onion fields has been caused by the onion thrips (*Thrips tabaci* Lindeman), a 3-acre field having been destroyed near New Haven.

As has already been reported (see Second Report of Connecticut State Entomologist for 1902, p. 174, and Canadian Entomologist, Vol. XXXV, p. 188), the twelve-spotted asparagus beetle (*Crioceris 12-punctata* Linn.) has been taken a number of times in Connecticut, and may now be considered as having become established here, though it is not as yet very abundant. The larvæ and adults of the common asparagus beetle (*Crioceris asparagi* Linn.) were killed by spraying the plants on the station grounds June 3 with arsenate of lead, 1¼ pounds in 20 gallons of water. This adheres to the slender foliage and stems better than most insecticides.

The elm leaf beetle (*Galerucella luteola* Müll.) did less damage to shade trees than for several years.

The tent caterpillar (*Clisiocampa americana* Harr.) was abundant throughout the central and northern portion of the State. The larvæ appeared very early (about April 1).

During August the larvæ of *Cingilia catenaria* were numerous at Terryville and devoured the leaves of sweet fern, huckleberry, sumac, scrub oak, and other low-growing plants. These pupated during the latter part of August, and the adults appeared nearly a month later. These were also very abundant.

There are good reasons for believing that the Chinese mantid (*Tenodera* [*Paratenodera*] *sinensis* Saus.) has been introduced into Connecticut directly from Japan and has become established here. Egg cases of the European mantis (*Mantis religiosa*) have been procured from central New York, and we hope that this species may soon aid in checking some of our troublesome species of plant-lice and other insects.

THE BROWN-TAIL MOTH IN NEW HAMPSHIRE.

By Clarence M. Weed, *Durham, N. H.*

Eastern Massachusetts has been for some time the home of two insect pests of special interest to the country at large. I refer, of course, to the brown-tail moth and the gypsy moth. As the first of these has within the last four years been gradually invading New Hampshire, I have thought a few notes concerning it would be worth bringing before you.

At our last meeting I reported to you that apparently the brown-tail moth was first introduced into New Hampshire in 1899 by means of a severe gale which carried the moths along the eastern coast of Massachusetts. A winter nest of the insect was found in the town of Seabrook, N. H., in December, 1899, by Mr. F. C. Moulton, of the gypsy moth commission.

Upon the passage of our nursery-inspection law last March I took steps to ascertain to what extent the insect had spread in the southeastern corner of the State. It very soon became evident that all the towns along the coast, at least, were already infested, and that the insect was slowly but surely spreading. Later investigations showed that very few moths were in the State away from the coast.

The region about Newburyport is very generally infested by the brown-tail moth. The evidence in hand indicates that the electric cars running from there to Portsmouth and Exeter have been the most important means of distribution, as the nests have been quite generally found along the car lines. This is what might be expected from the fact that these cars are continually coming from regions where the caterpillars are abundant on the trees overhanging the streets through which the cars run. Such caterpillars, frequently dropping as they do, might easily be carried on the cars themselves, or on the persons or effects of passengers. In a less degree the freight and passenger cars of the railroads may readily serve to distribute the pests, as well as various other sorts of vehicles, especially automobiles, which pass in great numbers through the infested area to regions in New Hampshire now uninfested.

One of the most serious effects of the presence of the brown-tail moth in a community is that of the peculiar skin disease it may produce. The hairs of the caterpillars are furnished with minute barbs. When the caterpillars molt these barbed hairs are shed with the skin, and as the skins become dry and are blown about by the wind the hairs may be quite generally disseminated. When the hairs alight upon the human skin they cause an irritation which, upon rubbing, may develop into inflammation. In New Hampshire this phase of the insect's presence has already become in evidence. At Portsmouth a clothes reel was near a tree infested by the caterpillars. The family were greatly troubled through the summer by extraordinary irritations of the skin, for which they were unable to account, but which were doubtless due to caterpillar hairs blown from the pear tree. In the same city a gentleman in removing a caterpillar which had landed on his neck scattered some of the hairs, which produced an eruption similar to but considerably worse than that produced by poison ivy.

The food preferences of the insect have been shown quite markedly in our observations. Pear seems to be the favorite food plant, with apple, wild cherry, plum, and hawthorn following along in about the order named.

AN EXPERIMENT WITH BLACK FLIES.

By Clarence M. Weed, *Durham, N. H.*

In the resort regions of northern New Hampshire the black flies have long been recognized as one of the most annoying pests for the summer visitor, as well as for the resident citizen. I have had, from time to time, appeals from hotel managers for help in subduing the pest, but until this year have had to confess that I knew of no probable solution of the problem. For several years I have had under observation a colony of black-fly larvæ living on the flat rocks of the outlet to our college reservoir, and have often tried to discover an effective means of killing them.

When studying the recent literature concerning mosquito remedies, the property of phinotas oil, which leads it to sink to the bottom in water, led me to think that possibly here we had an agent for destroying Simulion larvæ. Last June, in order to test the theory, I sent my assistant, Mr. A. F. Conradi, to Dixville Notch, N. H., where these pests have for many years been especially troublesome, with specific instructions to find the breeding places of the flies, and to try the effect of the phinotas oil with which he was provided.

The Dixville Notch region was peculiarly favorable as to situation for an extended experiment in subduing black flies, for it is a comparatively small area, surrounded by mountains over which no flies from other localities would be likely to come. A large part of the encompassed area is taken up by a beautiful lake. Upon arrival Mr. Conradi made a careful survey of the entire locality, finding no flies breeding in the swiftly running shaded streams along the mountain sides, but finding vast numbers breeding in shallow, sunlit waters at the wasteway from the lake, and in two or three other places. His notes upon the first experiment with the oil treatment are as follows:

> At the wasteway, near the lake dam, where the stream is approximately 5 feet wide, one-third of a gallon of phinotas oil was applied at 4 a. m., June 22. The effect was at once noticeable. At 2 p. m., the same day, most of the larvæ were dead, while the remainder were sluggish. On the afternoon of the next day, the conditions were carefully investigated and all the larvæ were found to be dead, not only where the oil was applied, but for 10 feet or so ahead as well.
>
> The oil was applied by simply pouring it over a shingle, thus scattering it somewhat. It sinks and rises, and lingers long about the place. Stones in the water picked up forty-eight hours after the application had a thin film of the oil still on them.

When Mr. Conradi reported the results of his trip it seemed to me that the problem was in part at least solved, the chief perplexing feature being the possible deleterious effect upon fish life of the application of the oil in quantity. From the similarity of the breeding places he found to the one I had been observing, it occurred to me that a little work with stiff brooms in sweeping free the masses of larvæ and then catching them downstream on wire netting stretched in the water might be helpful where the oil could not be applied. Accordingly, I sent to Dixville Notch a barrel of phinotas oil and a supply of stiff stable brooms. When these arrived Mr. Conradi was sent again with specific instructions as to the use of the brooms and the application of the oil, especially in the latter case as to its effect upon fish life. He found that the sweeping method was entirely practicable and offered in some breeding grounds a simple method of destroying the pests. He also found that in a brook 3 feet wide where in June the flies were breeding in vast quantities in which he had poured one-half gallon of phinotas oil, the young stages of the flies had been killed off for a distance of one-eighth of a mile from the place of application. As regards fish, he found that they swam rapidly down stream as soon as oil was applied, and apparently were able to escape without evil results to them.

Shortly after the treatment the adult black flies became so scarce that the hotel managers discarded the smudges which for the last twelve summers had been in daily use for the protection of the guests.

I believe that these experiments justify the hope that in the near future the black fly will be more easily controlled in centers of permanent or temporary population than is the mosquito.

A vote of thanks was extended to Doctor Fletcher for the efficient and impartial manner in which he had presided over the meeting. It was voted that the meeting adjourn to meet at the same time and place with the American Association for the Advancement of Science when it next assembles.

The meeting was then declared adjourned.

A. F. BURGESS, *Secretary.*

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U. S. DEPARTMENT OF AGRICULTURE,

DIVISION OF ENTOMOLOGY—BULLETIN No. 47.

L. O. HOWARD, Entomologist.

CATALOGUE

OF THE

EXHIBIT OF ECONOMIC ENTOMOLOGY

AT THE

LOUISIANA PURCHASE EXPOSITION, ST. LOUIS, MO., 1904.

COMPILED UNDER THE DIRECTION OF THE ENTOMOLOGIST

BY

E. S. G. TITUS AND F. C. PRATT.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1904.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Entomology,
Washington, D. C., March 25, 1904.

Sir: I have the honor to transmit herewith for publication, as Bulletin No. 47, of this Division, a catalogue of the exhibit made by the Division of Entomology at the Louisiana Purchase Exposition.

Respectfully,

L. O. Howard.
Entomologist.

Hon. James Wilson,
Secretary of Agriculture.

INTRODUCTION.

The following catalogue of the exhibit of economic entomology made by the Division of Entomology, U. S. Department of Agriculture, at the Louisiana Purchase Exposition, has been prepared with a view of increasing the usefulness of the exhibit from an economic and educational standpoint, and it is intended to supplement the exhibit by giving bibliographical references which will enable persons interested readily to gain information additional to that conveyed by the label. The general supervision of the preparation of the exhibit itself was placed by the writer in the hands of Mr. August Busck, assistant in the Division of Entomology, and in this laborious task he has had the valuable expert assistance of Mr. F. C. Pratt and Mr. E. S. G. Titus, also assistants in the Division. The catalogue itself has been compiled by Messrs. Titus and Pratt. The present catalogue does not include a consideration of the exhibit of insects injurious to forest trees, which will be published as a separate pamphlet on account of the desirability of independent distribution of this portion of the catalogue to persons interested in forestry matters.

The Division of Entomology has been represented at many international expositions, its first serious attempt to represent its work in this way having been made at the New Orleans Cotton Exposition of 1884. It was represented by large collections at the subsequent World's Fair at Chicago, at the International Exposition at Paris, at the expositions at Atlanta, Nashville, Omaha, Buffalo, and Charleston. The present exhibit, however, is, in many respects, a more interesting one than any of its predecessors. An effort has been made to illustrate in all of their stages the principal insects injurious to North American crops. Further attempts have been made to show the economic relations of insects in other respects and, on account of the great current interest in the subject of the spread of disease by insects, more attention has been paid to this subject than ever before. Special cases illustrating insects of the greatest immediate popular interest have been prepared, and a series of models of the most prominent economic insects of the day is shown. An effort has been made to introduce a novel feature in this exhibit, namely, living insects feeding under as natural conditions as possible, which will probably prove of quite as great interest to visitors as the illustrative cases of dried specimens.

In the bibliographical references under the titles of the individual exhibits in this catalogue the most comprehensive general articles have been indicated, and especial care has been taken to quote such publications as are most accessible. Reference to many of the earlier articles may be found in Bul. 31, Div. Ent., U. S. Dept. Agric., 1893, this being an index to the exhibit at the World's Columbian Exposition. In the systematic index the more important recent changes in entomological nomenclature have been cared for by cross references from old names to new names for both genera and species.

Persons desiring further information than can be gained from this catalogue or from conversation with the attendant in charge of exhibit are requested to address the writer at the U. S. Department of Agriculture, Washington, D. C.

L. O. Howard,
Entomologist.

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INSECTS INJURIOUS TO ORANGE AND LEMON.

For general articles relating to insects affecting these fruits see Hubbard, 1885, and Insects Affecting the Orange, U. S. Dept. Agric., Marlatt, Scale Insects and Mites of Citrus Fruits, Farmers' Bul. 172, 1903.

THE APPLE TWIG-BEETLE.

Stephanoderes hispidulus Lec.

(Formerly *Hypothenemus eruditus* auct.)

EXHIBIT: Adult and work.

THE OAK AMBROSIA BEETLE.

Xyleborus affinis Eichh.

For general account see Hubbard, Bul. 7, n. s., Div. Ent., U. S. Dept Agric., pp. 19–20, 1897, under *X. pubescens* Zimm.

EXHIBIT: Adult, work, and figure.

THE PAN-AMERICAN PLATYPUS.

Platypus compositus Say.

For general article see Hubbard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 14–16, 1897.

EXHIBIT: Adult, work, and figure.

FULLER'S ROSE BEETLE.

Aramigus fulleri Horn.

For general account of life history see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 88–96, 1901.

EXHIBIT: Adult.

THE COFFEE-BEAN WEEVIL.

Araecerus fasciculatus De G.

For partial life history and general account see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., pp. 36–38, 1897.

EXHIBIT: Adult and work.

THE ORANGE CHRYSOBOTHRIS.

Chrysobothris chrysœla Ill.

Exhibit: Adult.

EPITRAGUS TOMENTOSUS Lec.

Exhibit: Adult.

PACHNÆUS DISTANS Horn.

Exhibit: Adult.

ORANGE LEAF-NOTCHER.

Artipus floridanus Horn.

Exhibit: Adult and work.

THE ORANGE SAWYER.

Elaphidion inerme Newm.

For general account see Chittenden, Bul. 18, n. s., Div. Ent., U. S. Dept. Agric., p. 41, 1898.

Exhibit: Adult and work.

LEPTOSTYLUS BIUSTUS Lec.

Exhibit: Adult and work.

THE ORANGE DOG; HOG CATERPILLAR.

Papilio thoas Linn.

(Also called *P. cresphontes.*)

For brief account of larva see Lintner, 9th Rpt. State Ent. N. Y., pp. 336–337, 1893.

Exhibit: Eggs, larva, chrysalis, adult, and figure.

ORANGE LEAF-ROLLER.

Platynota rostrana Walk.

Exhibit: Eggs, pupa, and adult.

THE SADDLE-BACK CATERPILLAR.

Sibine stimulea Clem.

(Formerly *Empretia.*)

For general account see Lugger, 4th Rept. State Ent. Minn., pp. 98–99, 1899.

Exhibit: Pupa, adult, and figure.

THE COMMON BAGWORM.

Thyridopteryx ephemeræformis Steph.

For general account see Packard, 5th Rpt. U. S. Ent. Com., pp. 258–262, 1890.

Exhibit: Larva, cocoon, adult, and figure.

THE STINGING CATERPILLAR.

Megalopyge opercularis S. and A.

For short account see Lugger, 4th Rpt. State Ent. Minn., pp. 95–96, 1899.

Exhibit: Cocoon and adult.

THE SKIFF CATERPILLAR.

Prolimacodes scapha Harr.

(Larva feeds on leaves.)

Exhibit: Adult.

THE ORANGE CASE-BEARER.

Eurycyttarus confederata Grt.

(Larvæ feed upon lichens on tree trunk, occasionally gnawing fruit; formerly *Psyche*.)

Exhibit: Cases on twig.

THE TWO-SPOTTED RED SPIDER.

Tetranychus bimaculatus Harr.

For description and distribution see Banks, Tech. series 8, Div. Ent., U. S. Dept. Agric., pp. 73–74, 1900.

For general account see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 35–42, 1901.

Exhibit: Figure.

THE ORANGE WHITE SPOT.

Tetranychoides californica Bks.

For description see Banks, Journ. N. Y. Ent. Soc., v. XII, p. 54, pl. II, fig. 1, 1904.

Exhibit: Work and figure.

THE ORANGE FRUIT MITE.

Tenuipalpus californicus Bks.

For description see Banks, Journ. N. Y. Ent. Soc., v. XII, p. 55, pl. II, fig. 2, 1904.

Exhibit: Work and figure.

RUST MITE OF THE ORANGE; THE SILVER MITE OF THE LEMON.

Eriophyes oleivorus Ashm.

(Formerly *Phytoptus*.)

Exhibit: Figure.

THE TWO-STRIPED WALKING-STICK.

Anisomorpha buprestoides Stäl.

Exhibit: Nymph and adult.

THE ANGULAR-WINGED KATYDID.

Microcentrum retinerve Burm.

Exhibit: Eggs, adult, and parasitized eggs.

NORTHERN MOLE CRICKET.

Gryllotalpa borealis Burm.

Exhibit: Nymph and adult.

THE LUBBER GRASSHOPPER.

Dictyophorus reticulatus Thunb.

For brief account see Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agr., pp. 28–29, 1901.

Exhibit: Nymph and adult.

THE COTTON STAINER.

Dysdercus suturellus H-Schf.

For short accounts see Howard, Farmers' Bul. 47, U. S. Dept. Agric., pp. 30–31, 1897; Insect Book, p. 308, fig. 201 and pl. 31, fig. 15, 1901.

Exhibit: Nymph, adult, and figure.

EUTHOCTHA GALEATOR Fab.

Exhibit: Adult.

THE SOUTHERN LEAF-FOOTED PLANT-BUG.

Leptoglossus phyllopus Linn.

For general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 46–48, 1899.

Exhibit: Adult.

EUSCHISTUS SERVUS Say.

Exhibit: Adult.

NEZARA HILARIS Say.

Exhibit: Adult.

WHITE FLY; MEALY WING.

Aleyrodes citri R. & H.

For general account see Marlatt, Farmers' Bul. U. S. Dept. Agric., 172, pp. 36–38, 1903.

Exhibit: Adult, work and figure.

ORANGE APHIS; COTTON APHIS.

Aphis gossypii Glover.

(Curls leaves and stops young growth; usually well controlled by parasites and other enemies.)

For short account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 58–61, 1903.

Exhibit: Eggs, adult, work, figure, and the enemies: *Baccha clavata*, *Hemerobius* sp., *Chrysopa plorabunda*, and a hymenopterous parasite.

COTTONY CUSHION SCALE; FLUTED SCALE.

Icerya purchasi Mask.

(Food plants: Acacia, cypress, grasses, lemon, orange, pine, rose; see under "The more important scale insects" for life history and enemies.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 25–27, 1903.

Exhibit: Infested twig.

THE DESTRUCTIVE MEALY-BUG.

Pseudococcus citri Risso.

(Formerly *Dactylopius destructor*.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 99–100, 1903.

Exhibit: Infested leaves.

THE LONG-SPINED MEALY-BUG.

Pseudococcus longispinus Targ.

(Formerly *Dactylopius* spp. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 104–105, 1903.

Exhibit: Infested leaves.

THE FLORIDA WAX-SCALE.

Ceroplastes floridensis Comst.

(Food plants: Citrus, fig, myrtle, oleander.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 157, 1903.

Exhibit: Infested leaves.

THE BARNACLE SCALE.

Ceroplastes cirripediformis Comst.

(Food plants: Myrtle, orange, persimmon, quince.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 150, 1903.

Exhibit: Infested leaves.

THE SOFT SCALE.

Coccus hesperidum Linn.

(Food plants: Laurel, lemon, myrtle, oleander, orange, etc.; formerly a *Lecanium;* see under "More important scale insects.")

For bliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 168–170, 1903.

Exhibit: Infested twig.

THE HEMISPHERICAL SCALE.

Saissetia hemisphærica Targ.

(Food plants: Oleander, orange, peach, etc.; formerly a Lecanium; see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 202–203, 1903.

Exhibit: Infested twig.

THE BLACK SCALE.

Saissetia oleæ Bern.

(Food plants: Apple, apricot, olive, orange, pear, plum, rose; formerly a Lecanium; see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 205–206, 1903.

Exhibit: Infested twig.

THE OLEANDER SCALE.

Aspidiotus hederæ Vall.

(Food plants: Currant, box, cherry, olive, oleander, orange, etc.; formerly *A. nerii* Bouché; see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 260–264, 1903.

Exhibit: Infested twig.

THE ORANGE CHIONASPIS.

Chionaspis citri Comst.

(Food plants: Euonymus, orange, palms; see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bull. 88, Mass. Agr. Coll., pp. 214–215, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 270, 1901.

Exhibit: Infested twig.

THE RED SCALE OF CALIFORNIA.

Chrysomphalus aurantii Mask.

(Food plants: Agave, apple, fig, grape, lemon, orange, pear, plum, quince, willow, etc., formerly *Aspidiotus*; see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 287–288, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 268, 1901.

Exhibit: Infested twig.

THE CIRCULAR SCALE.

Chrysomphalus ficus Ashm.

(Food plants: Lemon, oleander, orange, palm, rose, etc.; see under "More important scale insects.")

For bibliography and food plants see *Chrysomphalus aonidum*, Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 286–287, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 269, 1901.

Exhibit: Infested twig.

THE PURPLE SCALE.

Lepidosaphes beckii Newm.

(Food plants; Citron, fig, lemon, oak, orange. Formerly known as *Mytilaspis citricola* Glov.; see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 305–306, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 261, 1901.

Exhibit: Infested twig.

GLOVER'S SCALE; LONG SCALE.

Lepidosaphes gloveri Pack.

(Food plants: Lime, magnolia, orange, palms. Formerly called *Mytilaspis;* see under "More important scale insects," for figures and enemies.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 309, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 265, 1901.

Exhibit: Infested twig.

THE CHAFF SCALE.

Parlatoria pergandei Comst.

(Food plants: Japonica, lemon, orange; see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 319–320, 1903; Marlatt, Yearbook U. S. Dept. Agric., 1900, p. 270, 1901.

Exhibit: Infested twigs.

THE MORE IMPORTANT SCALE INSECTS.

COTTONY CUSHION SCALE; FLUTED SCALE.

Icerya purchasi Mask.

(Food plants: Acacia, cypress, grasses, lemon, orange, pine, rose; etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 25–27, 1903.

Exhibit: Infested twigs, illustrations and enemies: *Chilocorus cacti*, *Corizus hyalinus*, *Novius cardinalis*, and *Piesma cinerea*.

THE LONG-SPINED MEALY-BUG.

Pseudococcus longispinus Targ.

(Formerly *Dactylopius* spp.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 104–105, 1903.

Exhibit: Infested leaves and figures.

THE DESTRUCTIVE MEALY-BUG.

Pseudococcus citri Risso.

(Formerly *Dactylopius destructor*.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 99–100, 1903.

Exhibit: Infested leaves.

COTTONY MAPLE SCALE.

Pulvinaria innumerabilis Rathv.

(Food plants: Alder, apple, box-elder, elm, grape, linden, maples, oak, willow, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 134–135, 1903; Howard, Bul. 22, n. s. Div. Ent. U. S. Dept. Agric., pp. 8–16, 1900, figs.

EXHIBIT: Infested twigs and figures.

THE BARNACLE SCALE.

Ceroplastes cirripediformis Comst.

(Food plants: Myrtle, orange, persimmon, quince.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 150, 1903.

EXHIBIT: Infested twig.

THE FLORIDA WAX-SCALE.

Ceroplastes floridensis Comst.

(Food plants: Citrus, fig, myrtle, oleander.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 157, 1903.

EXHIBIT: Infested twigs.

THE SOFT SCALE.

Coccus hesperidum Linn.

(Food plants: Laurel, lemon, myrtle, oleander, orange, etc.; formerly a *Lecanium*.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 168–170, 1903.

EXHIBIT: Infested twigs and figures.

THE TERRAPIN SCALE.

Eulecanium nigrofasciatum Perg.

(Food plants: Apple, birch, linden, maple, peach, plum, sycamore; formerly *Lecanium*.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 191, 1903; Pergande, Bul. 18, n. s. Div. Ent., U. S. Dept. Agric., pp. 26–29, 1898, figs.

EXHIBIT: Infested twig and figures.

THE HEMISPHAERICAL SCALE.

Saissetia hemisphærica Targ.

(Food plants: Oleander, orange, peach, etc.; formerly a *Lecanium*.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 202–203, 1903.

EXHIBIT: Infested twig.

THE BLACK SCALE.

Saissetia oleæ Bern.

(Food plants: Apple, apricot, olive, orange, pear, plum, rose; formerly a *Lecanium.*)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 205–206, 1903.

Exhibit: Infested twig, and parasite *Coccophagus cognatus* How.

THE ORANGE CHIONASPIS.

Chionaspis citri Comst.

(Food plants: Enonymus, orange, palms, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 214–215, 1903; Marlatt, Yearbook, U. S. Dept. Agric., f. 1900, p. 270, 1901.

Exhibit: Infested twig.

THE SCURFY BARK-LOUSE.

Chionaspis furfura Fitch.

(Food plants: Apple, cherry, currant, elm, pear, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 217–219, 1903; Howard, Yearbook, U. S. Dept. Agric., f. 1894, pp. 259–261, 1895, figs.; Banks, Bul. 34, Div. Ent., U. S. Dept. Agric., p. 14, 1902.

Exhibit: Infested twig and figures.

THE WEST INDIAN PEACH SCALE.

Diaspis pentagona Targ.

For bibliography and partial list of food plants under *Aulacaspis* see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 234–235, 1903; Riley and Howard, Ins. Life, Vol. VI, pp. 287–295, 1894, figs.; Banks, Bul. 34, Div. Ent., U. S. Dept. Agric., p. 21, 1902.

Exhibit: Infested twigs and figures.

THE ROSE SCALE.

Aulacaspis rosæ Bouche.

(Food plants: Blackberry, mango, myrtle, pear, raspberry, rose, Cycas, Ailanthus, etc.)

For bibliography see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 236, 1903; Banks, Bul. 34, Div. Ent., U. S. Dept. Agric., p. 23, 1902.

Exhibit: Infested twig and figure.

THE HORSE-CHESTNUT SCALE.

Aspidiotus æsculi Johns.

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 251–252, 1903.

Exhibit: Infested twigs.

PUTNAM SCALE; CRANBERRY SCALE.

Aspidiotus ancylus Putn.

(Food plants: Apple, apricot, box-elder, cottonwood, cranberry, elm, hemlock, maple, oak, peach, pear, plum, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 252–253, 1903.

Exhibit: Infested twig.

THE LINDEN SCALE.

Aspidiotus diffinis Newst.

(Food plants: Basswood, lilac.)

For bibliography see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 257, 1903.

Exhibit: Infested twigs.

THE EUROPEAN FRUIT SCALE.

Aspidiotus ostreæformis Curt.

(Food plants: Apple, cherry, maple, oak, peach, pear, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 268–270, 1903.

Exhibit: Infested twig and figures.

THE CHERRY; FORBES' SCALE.

Aspidiotus forbesi Johns.

(Food plants: Apple, cherry, currant, honey locust, peach, pear, plum, walnut, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 259–260, 1903.

Exhibit: Infested twig and figure.

THE GRAPE SCALE.

Aspidiotus uvæ Comst.

(Food plants: Grape, hickory.)

For bibliography see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 280, 1903.

Exhibit: Infested twig and figure.

THE WALNUT SCALE.

Aspidiotus juglans-regiæ Comst.

(Food plants: Ash, cherry, crab apple, currant, English walnut, locust, peach, pear, prune, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 265, 1903.

Exhibit: Infested twig and figure.

PALM SCALE.

Aspidiotus lataniæ Sign.

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 266–267, 1903.

Exhibit: Infested twig and leaves.

THE SAN JOSE SCALE.

Aspidiotus perniciosus Comst.

(Food plants: Almond, apple, apricot, birch, black walnut, black currant, catalpa, chestnut, crab apple, crab grass, cherry, grape, hickory, oak, peach, pear, persimmon, plum, poplar, prune, Rocky Mountain cherry, rose, silver maple, willow, and many other plants.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 271–275, 1903; Howard and Marlatt, Bul. 3, n. s. Div. Ent. U. S. Dept. Agric., 1896, 80 pp.

Exhibit: Infested twig, fruit, figures, and enemies: *Smilia misella* Lec., adult and figure; *Chilocorus similis* Rossi, larva, pupa, adult, and figure; parasite *Aphelinus diaspidis* How., adult and figure.

THE GREEDY SCALE.

Aspidiotus rapax Comst.

(Food plants: Cottonwood, maple, olive, pear, quince, apple, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 276–278, 1903.

Exhibit: Infested twig and figure.

THE OLEANDER SCALE.

Aspidiotus hederæ Vall.

(Food plants: Currant, box, cherry, olive, oleander, orange, etc.; formerly *A. nerii* Bouché.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 260–264, 1903.

Exhibit: Infested twig and figure.

THE CIRCULAR SCALE.

Chrysomphalus ficus Ashm.

(Food plants: Lemon, oleander, orange, palm, rose, etc.; formerly *Aspidiotus*.)

For bibliography and food plants see *Chrysomphalus aonidum*, Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 286–287, 1903; Marlatt, Yearbook U. S. Dept. Agric. f. 1900, p. 269, 1901.

Exhibit: Infested twig and figure.

THE CALIFORNIA RED SCALE.

Chrysomphalus aurantii Mask.

(Food plants: Agave, apple, fig, grape, lemon, orange, pear, plum, quince, willow, etc.; formerly *Aspidiotus.*)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 287–288, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 268, 1901.

Exhibit: Infested twig and figure.

GLOVER'S SCALE; LONG SCALE.

Lepidosaphes gloveri Pack.

(Food plants: Lime, magnolia, orange, palms; formerly *Mytilaspis.*)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 309, 1903; Marlatt, Yearbook, U. S. Dept. Agric, 1900, p. 265, 1901.

Exhibit: Infested twig, figures, and the following enemies: *Chilocorus bivulnerus* Muls., *C. cacti* Linn., *Coccinella abdominalis* Say, *C. californica* Mann., *C. sanguinea* Linn., *C. oculata* Fabr., *Dakruma coccidivora* Comst., *Exochomus contristatus* Muls., *Hippodamia ambigua* Lec., *H. convergens* Guen., *Hyperaspidius coccidivora* Ashm., *Scymnus bioculatus* Muls., *S. cervicalis* Muls.

OYSTER-SHELL BARK-LOUSE.

Lepidosaphes ulmi Linn.

(Attacks principally apple, currant, Cornus, cottonwood, lilac, pear, sassafras, etc.; formerly called *Mytilaspis pomorum* Bouché.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 314–317, 1903.

Exhibit: Infested twig and figure.

THE PURPLE SCALE.

Lepidosaphes beckii Newm.

(Food plants: Citron, fig, lemon, oak, orange; formerly known as *Mytilaspis citricola* Glov.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 305–306, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 261.

Exhibit: Infested twig and figure.

THE CHAFF SCALE.

Parlatoria pergandei Comst.

(Food plants: Japonica, lemon, orange.)

For bibliography and food-plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 319–320, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 270.

Exhibit: Infested twigs and figure.

WHITE FLY; MEALY WING.

Aleyrodes citri R. & H.

For general articles see Marlatt, Farmers' Bul. 172, U. S. Dept. Agric., pp. 36–38, 1903; also Ins. Life, v. V, pp. 219–226, 1893.

EXHIBIT: Adult, work. and figure.

INSECTS INJURIOUS TO APPLE.

For special treatises on apple insects see Bruner, Trans. Nebr. St. Hort. Soc. f. 1894, pp. 155–223, 1895; Harvey and Munson, Bul. 56, Maine Agr. Expt. Sta., 1899; Saunders, Insects Injurious to Fruits, 2d ed., pp. 13–139, 1900.

INJURING THE ROOTS.

THE WOOLLY APPLE APHIS.

Schizoneura lanigera Hausm.

For general account see Marlatt, Cir. 20, Div. Ent., U. S. Dept. Agric., 1897.

EXHIBIT: Work, figure, parasite, *Aphelinus mali* Hal.; and enemy *Scymnus cervicalis* Muls.

INJURING THE TRUNK.

FLAT-HEADED APPLE-TREE BORER.

Chrysobothris femorata Fab.

For general account see Chittenden, Cir. 32, Div. Ent., U. S. Dept. Agric., pp. 9–12, 1898.

EXHIBIT: Adult, work, and figure.

ROUND-HEADED APPLE-TREE BORER.

Saperda candida Fab.

For general account see Chittenden, Cir. 32, Div. Ent., U. S. Dept. Agric., pp. 1–8, 1898.

EXHIBIT: Adult, work, and figure.

APPLE-WOOD STAINER; PIN-BORER.

Pterocyclon mali Fitch.

(Formerly *Monarthrum*.)

For general account of this and an allied species, *M. fasciatum*, see Hubbard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 26–28, 1897.

EXHIBIT: Adult and figure.

INJURING THE BRANCHES.

THE APPLE-TREE PRUNER.

Elaphidion villosum Fabr.

For full account and food plants see Chittenden, Bul. 18, n. s., Div. Ent., U. S. Dept. Agric., pp. 35–40, 1898.

EXHIBIT: Adult, work, and figure.

THE NEW YORK WEEVIL.

Ithycerus noveboracensis Först.

For general account see Lugger, 5th Rpt. St. Ent. Minn., pp. 187–189, 1899.

EXHIBIT: Adult and work.

THE APPLE TWIG-BORER.

Amphicerus bicaudatus Say.

For general account see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 11–13, fig., 1898.

EXHIBIT: Adult, work, and figure.

THE APPLE TWIG-BEETLE.

Stephanoderes hispidulus Lec.

(Formerly called *Hypothenemus*.)

EXHIBIT: Adult and work.

PEAR-BLIGHT BEETLE; SHOT-BORER.

Xyleborus pyri Peck.

(Formerly called *X. dispar*.)

For general account see Hubbard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 22–23, 1897.

EXHIBIT: Adult and work.

THE COSMOPOLITAN AMBROSIA BEETLE.

Xyleborus saxeseni Ratz.

(Formerly called *X. xylographus*.)

For general account see Hubbard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 24–26, 1897.

EXHIBIT: Adult.

FRUIT-TREE BARK BEETLE; THE SHOT-HOLE BORER.

Scolytus rugulosus Ratz.

For general account see Chittenden, Cir. 29, Div. Ent., U. S. Dept Agric., 1898.

EXHIBIT: Adult and figure.

THE BUFFALO TREE-HOPPER.

Ceresa bubalus Say.

For general account see Marlatt, Cir. 23, Div. Ent., U. S. Dept. Agric., 1897.

EXHIBIT: Adult, work, and figure.

THE PERIODICAL CICADA.

Tibicen septendecim Linn.

(See special case containing life history, with illustrations of this insect and its work.)

For life history and general article see Marlatt, Bul. 14, n. s., Div. Ent., U. S. Dept Agric., 1898.

Exhibit: Pupa, pupa skins, and adult.

THE SAN JOSE SCALE.

Aspidiotus perniciosus Comst.

(Food plants: Almond, apple, apricot, birch, black walnut, black currant, catalpa, chestnut, crab apple, crab grass, cherry, grape, hickory, oak, peach, pear, persimmon, plum, poplar, prune, Rocky Mountain cherry, rose, silver maple, willow, and many other plants. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 271–275, 1903; Howard and Marlatt, Bul. 3, n. s., Div. Ent., U. S. Dept. Agric., 1896. 80 pp.

Exhibit: Infested twig.

PUTNAM SCALE; CRANBERRY SCALE.

Aspidiotus ancylus Putn.

(Food plants: Apple, apricot, box elder, cottonwood, cranberry, elm, hemlock, maple, oak, peach, pear, plum, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 252–253, 1903.

Exhibit: Infested twig.

THE CHERRY SCALE; FORBES' SCALE.

Aspidiotus forbesi Johns.

(Food plants: Apple, cherry, currant, honey locust, peach, pear, plum, walnut, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 259–260, 1903.

Exhibit: Infested twig.

THE GREEDY SCALE.

Aspidiotus rapax Comst.

(Food plants: Cottonwood, maple, olive, pear, quince, apple, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 276–278, 1903.

Exhibit: Infested twig.

THE EUROPEAN FRUIT-SCALE.

Aspidiotus ostreæformis Curt.

(Food plants: Apple, cherry, maple, oak, peach, pear, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 268–270, 1903.

Exhibit: Infested twig.

THE SCURFY BARK LOUSE.

Chionaspis furfura Fitch.

(Food plants: Apple, cherry, currant, elm, pear, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 217–219, 1903; Howard, Yearbook, U. S. Dept. Agric., 1894, pp. 259–261, figs.; Banks, Bul. 34, Div. Ent., U. S. Dept. Agric., p. 14, 1902.

Exhibit: Infested twig.

OYSTER-SHELL BARK-LOUSE.

Lepidosaphes ulmi Linn.

(Attacks principally apple, currant, Cornus, cottonwood, lilac, pear, sassafras, etc. Formerly called *Mytilaspis pomorum* Bouché. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 314–317, 1903.

Exhibit: Infested twig.

THE BLACK SCALE.

Saissetia oleæ Bern.

(Food plants: Apple, apricot, olive, orange, pear, plum, rose; formerly a Lecanium. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 205–206, 1903.

Exhibit: Infested twig.

INJURING THE LEAVES.

PISTOL CASE-BEARER.

Coleophora malivorella Riley.

(Feeds on leaves and buds.)

For general account see Slingerland, Bul. 124, Cornell Univ. Agr. Expt. Sta., 1897.

Exhibit: Cocoon, adult, work, and figure.

EYE-SPOTTED BUD-MOTH.

Tmetocera ocellana Schiff.

(Feeds on buds and young leaves.)

For general account see Slingerland, Bul. 50, Cornell Univ. Agr. Expt. Sta., 1893.

Exhibit: Pupa, adult, and work.

APPLE-TREE BUCCULATRIX.

Bucculatrix pomifoliella Clem.

For general account and partial bibliography see Slingerland and Fletcher, Bul. 214, Cornell Univ. Agr. Expt. Sta., pp. 69–78, figs., 1903.

Exhibit: Cocoon, adult, and figure.

THE RESPLENDENT SHIELD-BEARER.

Coptodisca splendoriferella Clem.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 263–265, 1899.

Exhibit: Cocoon, adult, work, and figure.

CHAPIN'S APPLE-LEAF SEWER.

Ancylis nubeculana Clem.

For brief article see Lugger, 4th Rpt. St. Ent. Minn., pp. 239–240, 1899.

Exhibit: Pupa, adult, work, and figure.

THE OBLIQUE-BANDED LEAF-ROLLER.

Archips rosaceana Harr.

(Formerly *Cacoecia.*)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 226–227, 1899.

Exhibit: Pupa, adult, and work.

THE LESSER APPLE LEAF-FOLDER.

Acleris minuta Rob.

(Formerly *Teras.*)

For general account see J. B. Smith, Farmers' Bul. 178, U. S. Dept. Agric., pp. 12–17, 1903.

Exhibit: Pupa and adult.

THE LEAF CRUMPLER.

Mineola indiginella Zell.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 211–213, 1899.

Exhibit: Cocoon, pupa, adult, and figure.

THE APPLE-LEAF SKELETONIZER.

Canarsia hammondi Riley.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 217–218, 1899.

Exhibit: Pupa, adult, and work.

APPLE-TREE TENT-CATERPILLAR.

Malacosoma americana Fab.

(Formerly *Clisiocampa.*)

For life history and bibliography see Felt, 14th Rpt. St. Ent. N. Y., pp. 177–190, 1898.

Exhibit: Eggs, larva, cocoon, pupa, adult and work, and the parasites; *Pimpla conquisitor* Say, and *Ichneumon lætus* Brullé.

THE LIME-TREE WINTER-MOTH.

Erannis tiliaria Harr.

(Formerly *Hibernia.*)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 193–195, 1899.

Exhibit: Pupa, adult, and figure.

THE ELM SPAN-WORM.

Ennomos subsignarius Hbn.

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 232–233, 306–307, 1890.

Exhibit: Eggs, larva, pupa, and work.

THE APPLE LEAF-MINER.

Tischeria malifoliella Clem.

For life history and bibliography see Lintner, 11th Rpt. N. Y. St. Ent., pp. 160–162, 1896.

Exhibit: Adult and work.

THE SPRING CANKER-WORM.

Paleacrita vernata Peck.

For general account see Coquillett, Circ. 9, Div. Ent., U. S. Dept. Agric., pp. 1–3, 1895.

Exhibit: Larva, adult, and figure.

THE FALL CANKER-WORM.

Alsophila pometaria Harr.

(Formerly *Anisopteryx.*)

For general account see Coquillett, Circ. 9, Div. Ent., U. S. Dept. Agric., pp. 3–4, 1895.

Exhibit: Eggs, larva, cocoon, adult, and figure.

THE WHITE-MARKED TUSSOCK-MOTH.

Hemerocampa leucostigma S. & A.

(Larvæ feed extensively upon fruit and shade trees and often damage shrubs and vines; see special case containing life history and parasites.)

For general account of this insect and its parasites see Howard, Tech. Ser., 5, Div. Ent., U. S. Dept. Agric., 1897; for life history, etc., Howard, Farmers' Bul. 99, pp. 12–20, 1899.

Exhibit: Egg-masses, larva, and adult.

THE FALL WEB-WORM.

Hyphantria cunea Dru.

For general account see Howard, Farmers' Bul. 99, U. S. Dept. Agric., pp. 20–25, 1899.

Exhibit: Larva, pupa, adult, and work.

THE COMMON BAGWORM.

Thyridopteryx ephemeræformis Steph.

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 258–262, 1890.

Exhibit: Cocoons and figure.

IO MOTH.

Automeris io Fab.

For general account see Lugger, 4th Rpt. State Ent. Minn., pp. 126–129, fig. 130, and pl. 16, fig. 129, 1899.

Exhibit: Adult.

THE BROWN-TAIL MOTH.

Euproctis chrysorrhœa Linn.

For life history and general article see Fernald and Kirkland, Spec. Bul. Hatch. Expt. Sta., Mass., 15 pp., 1 fig., 3 pls., 1898.

Exhibit: Larva, adult and figure.

THE GYPSY MOTH.

Porthetria dispar Linn.

For life history, habits and general account see Forbush and Fernald, "The Gypsy Moth," 495 pp. + i–c, 1896; Howard, Bul. 11, n. s., Div. Ent., U. S. Dept. Agric., 1897.

Exhibit: Larva, adult, and figure.

THE CLIMBING CUTWORM.

Euxoa scandens Riley.

(Formerly *Carneades.*)

For general account see Slingerland, Bul. 104, Cornell Univ. Agr. Expt. Sta., pp. 567–569, Pl. I, 1895.

Exhibit: Adult.

APPLE-TREE APHIS.

Aphis mali Fitch.

For general account see Smith, Bul. 143, N. J. Agr., Expt. Sta., 1900.

For general article treating of several species occurring on apple see Pergande, Bul. 44 Div. Ent., U. S. Dept. Agric., pp. 5–23, 1904.

Exhibit: Work and figure and the following enemies: *Adalia bipunctata* L., *Anatis 15-punctata* Ol., *Coccinella novemnotata* Hbst., *C. sanguinea* L., *Harmonia picta* Rand., *Hippodamia convergens* Guen., and *H. 13-punctata* L.

THE CECROPIA SILK MOTH.

Samia cecropia Linn.

For general account see Riley, 4th Rpt. Ins. Mo., pp. 103-111, 1872.

EXHIBIT: Larva, cocoon, and adult.

THE IMBRICATED SNOUT-BEETLE.

Epicærus imbricatus Say.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 28–29, 1903, and Bul. 19, n. s., pp. 62–67, 1899.

EXHIBIT: Adult.

SYNETA ALBIDA Lec.

For brief notice see Riley and Howard, Insect Life, v. IV, p. 396, 1892.

EXHIBIT: Adult and work.

RED-LEGGED FLEA-BEETLE.

Crepidodera rufipes Linn.

For general article see Insect Life, v. V, pp. 334–342, 1893.

EXHIBT: Adult.

THE APPLE-LEAF FLEA-WEEVIL.

Orchestes pallicornis Say.

For short account of life history see Forbes, Trans. Ill. St. Hort. Soc., f. 1901, p. 147, 1902.

EXHIBIT: Adult.

INJURING THE FRUIT.

TEN-SPOTTED XANTHONIA.

Xanthonia decemnotata Say.

EXHIBIT: Adult and work.

THE INDIAN EUPHORIA.

Euphoria inda Linn.

For life history and general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 67–74, 1899.

EXHIBIT: Adult and work.

JUNE BEETLE; FIG EATER.

Allorhina nitida Linn.

For general account see Howard, Bul. 10, n. s., Div. Ent., U. S. Dept. Agric., pp. 20-26, 1898.

EXHIBIT: Adult.

CODLING MOTH; APPLE WORM.

Carpocapsa pomonella Linn.

For full bibliography, life history, and illustrations see Simpson, Bul. 41, Div. Ent., U. S. Dept. Agric., 105 pp., 1903, figs.

EXHIBIT: Full life history (larva, pupa, cocoons, and adult) and parasites: *Pimpla annulipes* and *P. conquisitor*. Enemies: *Chauliognathus pennsylvanicus* and *Telephorus bilineatus*.

THE GREEN FRUIT-WORMS.

The three following species of *Xylina* are commonly known as green fruit-worms.

For general account see Slingerland, Bul. 123, Cornell Univ. Agr. Expt. Sta., 1896.

Xylina antennata Walk.

Exhibit: Adult and figure.

Xylina grotei Riley.

Exhibit: Adult and figure.

Xylina laticinerea Grote.

Exhibit: Adult and figure.

ILLUSTRATION SHOWING WORK OF A TORTRICID ON APPLE.

(The larva mines in and feeds beneath the skin of the fruit.)

THE PLUM CURCULIO.

Conotrachelus nenuphar Hbst.

For general account and bibliography see Lintner, 7th Rpt. N. Y. St. Ent., pp. 288–296, 1891.

Exhibit: Adult and figure.

THE APPLE CURCULIO.

Anthonomus quadrigibbus Say.

For general account see Gillette, Bul. 11, Iowa Agric. Expt. Sta., pp. 492–494, 1890.

Exhibit: Adult and figure.

THE APPLE-FRUIT MAGGOT.

Rhagoletis pomonella Walsh.

(Formerly *Trypeta.*)

For life history see Harvey, Rpt. Maine Agr. Expt. Sta., p. 190, 1889; Banks, Bul. 34, Div. Ent., U. S. Dept. Agric., p. 45, 1902.

Exhibit: Puparium, adult, and figure.

THE PERIODICAL CICADA.

THE PERIODICAL CICADA.

Tibicen septendecim Linn.

(Injures by deposition of eggs in the twigs almost all fruit, shade, and forest trees. Formerly *Cicada.*)

For life history and general article see Marlatt, Bul. 14, n. s., Div. Ent., U. S. Dept. Agric. 1898.

Exhibit: Full life history with figures. Enemies: *Megastizus speciosus* Dru. (adult and figure), *Oripoda elongata* (figure), *Pediculoides ventricosus* (figure).

THE WHITE-MARKED TUSSOCK MOTH AND ITS PARASITES.

For general account of this insect and the parasites affecting it see Howard, Tech. series, 5, Div. Ent., U. S. Dept. Agric., 1897. For life history, etc., see Howard, Farmers' Bul. 99, U. S. Dept. Agric., pp. 12–20, 1899.

THE WHITE-MARKED TUSSOCK-MOTH.

Hemerocampa leucostigma S. & A.

(Larvæ feed extensively upon fruit and shade trees and often damage shrubs and vines.)

Exhibit: Egg masses, larva, pupa, cocoon, adult, figure, and the following parasites:

Primary Hymenopterous Parasites.

Pimpla conquisitor Say.

Exhibit: Adult, cocoon, and figure.

Pimpla annulipes Say.

Exhibit: Adult.

Pimpla inquisitor Say.

Exhibit: Adult, cocoon, and figure.

Apanteles hyphantriæ Riley.

Exhibit: Adult and cocoon.

Meteorus communis Cress.

Exhibit: Adult and cocoon.

Limneria valida Cress.

Exhibit: Adult and cocoon.

Chalcis ovata Say.

Exhibit: Adult.

Secondary Hymenopterous Parasites.

Dibrachys boucheanus Ratz.

(Parasitic on *Pimpla*, *Meteorus*, etc.)

Exhibit: Adult and figure.

Chalcis debilis Say.

(Parasite on *Pimpla*, *Meteorus*, etc.)

Exhibit: Adult and cocoon.

Tertiary Hymenopterous Parasites.

Ascodes albitarsis Ashm.

(Parasite on *Dibrachys*.)

Exhibit: Adult and figure.

Primary Dipterous Parasites.

Tachina mella Walk.

Exhibit: Adult.

Frontina aletiæ Riley.

Exhibit: Adult.

INSECTS INJURIOUS TO PEACH.

Saunders, Insects Injurious to Fruit, 2d edit., pp. 191–200, 1900.

THE NATIVE PEACH BARK-BEETLE.

Phlœophthorus liminaris Harr.

(Formerly called *Phlœotribus.*)

For general account see Lintner, 9th Rpt. N. Y. St. Ent., pp. 365–368, 1893.

Exhibit: Adult and work.

THE FRUIT-TREE BARK-BEETLE.

Scolytus rugulosus Ratz.

For general account see Chittenden, Circ. 29, Div. Ent., U. S. Dept. Agric., 1898.

Exhibit: Adult, work, figure, and the parasite *Chiropachys colon.*

THE PEACH-TREE BORER.

Sanninoidea exitiosa Say.

(Formerly *Sannina.*)

For general account see Marlatt, Circ. 17, Div. Ent., U. S. Dept. Agric., 1896.

Exhibit: Pupa, cocoon, adult, and figure.

THE PERIODICAL CICADA.

Tibicen septendecim Linn.

(Injures by deposition of eggs in the twigs almost all fruit, shade, and forest trees. See special case containing stages and illustrations.)

For life history and general article see Marlatt, Bul. 14, n. s., Div. Ent., U. S. Dept. Agric., 1898.

Exhibit: Pupa, adult, and enemy *Megastizus speciosus.*

THE BLUE-SPANGLED PEACH-MOTH.

Haploa lecontei Boisd.

(Formerly *Callimorpha.*)

For general account see Saunders, Insects Injurious to Fruit, 2d edit., pp. 197–199, 1900.

Exhibit: Adult.

THE PEACH-TWIG MOTH.

Anarsia lineatella Zell.

For general article with bibliography see Marlatt, Bul. 10, n. s., Div. Ent., U. S. Dept. Agric., pp. 7–20, 1898.

Exhibit: Pupa, adult, work, and figure.

THE INDIAN FRUIT-FLY.

Ceratitis capitata Wied.

For general article see Riley, Rpt. U. S. Dept. Agric., 1890, pp. 255–257.

Exhibit: Pupa, adult, and figure.

THE PEACH SCALE.

Eulecanium persicæ Fabr.

(Food plants: Peach, plum, quince, etc.; formerly a Lecanium. See under "More important scale insects.")

For bibliography, food plants, and distribution see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 191–193, 1903.

Exhibit: Infested twig.

PUTNAM SCALE; CRANBERRY SCALE.

Aspidiotus ancylus Putn.

(Food plants: Apple, apricot, box-elder, cottonwood, cranberry, elm, hemlock, maple, oak, peach, pear, plum, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 252–253, 1903.

Exhibit: Infested twig.

THE SAN JOSE SCALE.

Aspidiotus perniciosus Comst.

(Food plants: Almond, apple, apricot, birch, black walnut, black currant, catalpa, chestnut, crab-apple, crab-grass, cherry, grape, hickory, oak, peach, pear, persimmon, plum, poplar, prune, Rocky Mountain cherry, rose, silver maple, willow, and many other plants. See under "More important scale insects."

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 271–275, 1903; Howard and Marlatt, Bul. 3, n. s., Div. Ent., U. S. Dept. Agric., 1896, 80 pp.

Exhibit: Infested twig.

THE CHERRY LEAF-BEETLE.

Galerucella cavicollis Lec.

For general article and distribution see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 90–93, 1899.

Exhibit: Adult.

THE CHERRY-FRUIT MAGGOT.

Rhagoletis cingulata Loew.

For detailed account see Slingerland, Bul. 172, Cornell Univ. Agr. Exp. Sta., 41 pp., 6 figs., 1899; Chittenden, Bul. 44, Div. Ent., U. S. Dept. Agric., p. 70–75, 1904.

Exhibit: Adult.

INSECTS INJURIOUS TO PEAR.

(Many of the insects injuring the apple will be found attacking the pear.)

THE FRUIT-TREE BARK-BEETLE.

Scolytus rugulosus Ratz.

For general account see Chittenden, Circ. 29, Div. Ent., U. S. Dept. Agric., 1898.

Exhibit: Adult, work, and figure.

PEAR-BLIGHT BEETLE; SHOT-BORER.

Xyleborus pyri Peck.

(Formerly called *X. dispar.*)

For general account see Hubbard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 22–23, 1897.

Exhibit: Adult, work, and figure.

THE PEAR BLISTER MITE.

Eriophyes pyri Pagenst.

For detailed account see Slingerland, Bul. 61, Cornell Univ. Agr. Exp. Sta., pp. 317–328, figs., 1893.

Exhibit: Work and figure.

THE PEAR PSYLLA.

Psylla pyri Linn.

For general accounts see Slingerland, Bul. 44, Cornell Univ. Agr. Sta., 1892; Marlatt, Circ. 7, Div. Ent., U. S. Dept. Agric., 1895.

Exhibit: Adult and figure.

THE PEAR SLUG.

Eriocampoides limacina Ratz.

(Formerly *Eriocampa cerasi.*)

For general account see Marlatt, Circ. 28, Div. Ent., U. S. Dept. Agric., 1897.

Exhibit: Adult, work, and figure.

THE SCURFY BARK-LOUSE.

Chionaspis furfura Fitch.

(Food-plants: Apple, cherry, currant, elm, pear, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 217-219, 1903; Howard, Yearbook, U. S. Dept. Agric., 1894, pp. 259–261, figs.; Banks, Bul. 34, Div., Ent., U. S. Dept. Agric., p. 14, 1902.

Exhibit: Infested twig.

SINUATE PEAR-BORER.

Agrilus sinuatus Oliv.

For general accounts see Smith, Rpt. Entom. N. J. Agr. Exp. Sta. f. 1894, pp. 556–561, 1895; Banks, Bul. 34, Div. Ent., U. S. Dept. Agric., pp. 40–41, 1902.

EXHIBIT: Adult and figure.

INSECTS INJURIOUS TO PLUM.

THE PLUM CURCULIO.

Conotrachelus nenuphar Hbst.

For general account and bibliography see Lintner, 7th Rpt. N. Y. St. Ent., pp. 288–296, 1891.

EXHIBIT: Adult, figure, and enemies, *Aspidoglossa subangulata*, *Chauliognathus pennsylvanicus*, *Harpalus caliginosus*, and parasite *Sigalphus curculionis*.

THE PLUM GOUGER.

Anthonomus prunicida Walsh.

(Formerly *Coccotones.*)

For general accounts see Riley and Howard, Insect Life, v. II, pp. 258–259, 1890; Gillette, Bul. 47, Colo. Agr. Exp. Sta., pp. 20–22, 1898.

EXHIBIT: Adult, work, and figure.

THE HOP PLANT-LOUSE.

Phorodon humuli Schr.

(Attacks hop and plum.)

For full life history see Riley, Circ. 2, Div. Ent., U. S. Dept. Agric., 1891.

EXHIBIT: Adult and work.

FORBES' SCALE; CHERRY SCALE.

Aspidiotus forbesi Johns.

(See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 259–260, 1903.

EXHIBIT: Infested twig.

INSECTS LIABLE TO BE DISTRIBUTED ON NURSERY STOCK.

See Banks, Bul. 34, Div. Ent., U. S. Dept. Agric., 46 pp., 1902.

THE PEACH SCALE.

Eulecanium persicæ Fab.

(Food plants: Peach, plum, quince, etc.; formerly a *Lecanium.* See under "More important scale insects.")

For bibliography, food plants, and distribution see Fernald, Cat. Coccidæ of World, Bul. 38, Mass. Agr. Coll., pp. 191–193, 1903.

EXHIBIT: Infested twig.

OYSTER-SHELL BARK-LOUSE.

Lepidosaphes ulmi Linn.

(Attacks principally apple, currant, Cornus, cottonwood, lilac, pear, sassafras, etc.; formerly called *Mytilaspis pomorum* Bouché. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 314–317, 1903.

Exhibit: Infested twig.

THE SCURFY BARK-LOUSE.

Chionaspis furfura Fitch.

(Food plants: Apple, cherry, currant, elm, pear, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 217–219, 1903; Howard, Yearbook, U. S. Dept. Agric., 1894, pp. 259–261, fig.

Exhibit: Infested twig.

THE SAN JOSE SCALE.

Aspidiotus perniciosus Comst.

(Food-plants: Almond, apple, apricot, birch, black walnut, black currant, catalpa, chestnut, crab-apple, crab-grass, cherry, grape, hickory, oak, peach, pear, persimmon, plum, poplar, prune, Rocky Mountain cherry, rose, silver maple, willow, and many other plants. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 271–275, 1903; Howard and Marlatt, Bul. 3, n. s., Div. Ent., U. S. Dept. Agric., 1896. 80 pp.

Exhibit: Infested twig.

PUTNAM SCALE; CRANBERRY SCALE.

Aspidiotus ancylus Putn.

(Food-plants: Apple, apricot, box-elder, cottonwood, cranberry, elm, hemlock, maple, oak, peach, pear, plum, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 252–253, 1903.

Exhibit: Infested twig.

THE CHERRY SCALE; FORBES' SCALE.

Aspidiotus forbesi Johns.

(Food-plants: Apple, cherry, currant, honey locust, peach, pear plum, walnut, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 259–260, 1903.

Exhibit: Infested twig.

THE WALNUT SCALE.

Aspidiotus juglans-regiæ Comst.

(Food-plants: Ash, cherry, crab-apple, currant, English walnut, locust, peach, pear, prune, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 265, 1903.

Exhibit: Infested twig.

THE GREEDY SCALE.

Aspidiotus rapax Comst.

(Food-plants: Cottonwood, maple, olive, pear, quince, apple, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 276–278, 1903.

Exhibit: Infested twig.

THE EUROPEAN FRUIT SCALE.

Aspidiotus ostreæformis Curt.

(Food-plants: Apple, cherry, maple, oak, peach, pear, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 268–270, 1903.

Exhibit: Infested twig.

THE WEST INDIAN PEACH SCALE.

Diaspis pentagona Targ.

(See under "More important scale insects.")

For bibliography and partial list of food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 234–235, 1903; Riley and Howard, Insect Life, v. VI, pp. 287–295, figs., 1894.

Exhibit: Infested twig.

THE ROSE SCALE.

Aulacaspis rosæ Bouché.

(Food-plants: Blackberry, mango, myrtle, pear, raspberry, rose, Cycas, Ailanthus, etc. See under "More important scale insects.")

For bibliography see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 236, 1903.

Exhibit: Infested twig.

THE WOOLLY APPLE APHIS.

Schizoneura lanigera Hausm.

For general account see Marlatt, Cir. 20, Div. Ent., U. S. Dept. Agric., 1897.

Exhibit: Infested roots, twigs, and figure.

THE BLACK PEACH APHIS.

Aphis persicæ-niger Sm.

Original description E. F. Smith, Ent. Amer., pp. 101–103, 1890.

For general account see Slingerland, Bul. 49, Cornell Univ. Agr. Expt. Sta., pp. 427–433, figs. 1892.

Exhibit: Figure.

APPLE-TREE APHIS.

Aphis mali Fitch.

For general account separating species occurring on apple see Pergande, Bul. 44, Div. Ent., U. S. Dept. Agric., pp. 5–23, 1904.

For general account see Smith, Bul. 14, N. J. Agr. Expt. Sta., 1900.

Exhibit: Figure.

THE BUFFALO TREE-HOPPER.

Ceresa bubalus Say.

For general account see Marlatt, Circ. 23, Div. Ent., U. S. Dept. Agric., 1897.

Exhibit: Adult and figure.

APPLE-TREE TENT-CATERPILLAR.

Malacosoma americana Fab.

(Formerly *Clisiocampa.*)

For life history and bibliography see Felt, 14th Rpt. N. Y. St. Ent., pp. 177–190, 1898.

Exhibit: Adult and figure.

THE FALL WEB-WORM.

Hyphantria cunea Dru.

For general account see Howard, Farmers' Bul. 99, U. S. Dept. Agric., pp. 20–25, 1899.

Exhibit: Adult.

THE BROWN-TAIL MOTH.

Euproctis chrysorrhœa Linn.

For life history and general article see Fernald and Kirkland, Spec. Bul. Hatch Expt. Sta., Mass., pp. 15, 1 fig., 3 pls., 1898.

Exhibit: Larva and adult.

THE WHITE-MARKED TUSSOCK-MOTH.

Hemerocampa leucostigma S. & A.

(Larvæ feed extensively upon fruit and shade trees, and often damage shrubs and vines; see special case containing life history and parasites.)

For general account of this insect and its parasites see Howard, Bul. Tech. ser., 5, Div. Ent., U. S. Dept. Agric., 1897; for life history, Howard, Farmers' Bul. 99, pp. 12–20, 1899.

Exhibit: Larva and adult.

THE LEAF CRUMPLER.

Mineola indiginella Zell.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 211–213, 1899.

Exhibit: Larva and adult.

THE GYPSY MOTH.

Porthetria dispar Linn.

For life history, habits, and general account see Forbush and Fernald, The Gypsy Moth, pp. 495+i–c, 1896.

Exhibit: Larva, adult, and figure.

THE SPRING CANKER-WORM.

Paleacrita vernata Peck.

For general account see Coquillett, Circ. 9, Div. Ent., U. S. Dept. Agric., pp. 1–3, 1895.

Exhibit: Adult and figure.

THE FALL CANKER-WORM.

Alsophila pometaria Harr.

(Formerly *Anisopteryx.*)

For general account see Coquillett, Circ. 9, Div. Ent., U. S. Dept. Agric., pp. 3–4, 1895.

Exhibit: Eggs, adult, and figure.

THE PEACH-TREE BORER.

Sanninoidea exitiosa Say.

(Formerly *Sannina.*)

For general account see Marlatt, Circ. 17, Div. Ent., U. S. Dept. Agric., 1896.

Exhibit: Adult and figure.

THE PEACH-TWIG MOTH.

Anarsia lineatella Zell.

For general article with bibliography see Marlatt, Bul. 10, n. s., Div. Ent., U. S. Dept. Agric., pp. 7–20, 1898.

Exhibit: Adult.

EYE-SPOTTED BUD-MOTH.

Tmetocera ocellana Schiff.

(Feeds on buds and young leaves.)

For general account see Slingerland, Bul. 50, Cornell Univ. Agric. Expt. Sta., 1893.

Exhibit: Adult and figure.

THE COMMON BAGWORM.

Thyridopteryx ephemeræformis Steph.

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 258–262, 1890.

Exhibit: Adult, cocoon, and figure.

THE APPLE-TWIG BORER.

Amphicerus bicaudatus Say.

For general account see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 11–13, figure, 1898.

Exhibit: Adult and figure.

ROUND-HEADED APPLE-TREE BORER.

Saperda candida Fab.

For general account see Chittenden, Circ. 32, Div. Ent., U. S. Dept. Agric., pp. 1–8, 1898.

Exhibit: Adult and figure.

FLAT-HEADED APPLE-TREE BORER.

Chrysobothris femorata Fab.

For general account see Chittenden, Circ. 32, Div. Ent., U. S. Dept. Agric., pp. 9–12, 1898.

Exhibit: Adult and figure.

FRUIT-TREE BARK BEETLE; SHOT-HOLE BORER.

Scolytus rugulosus Ratz.

For general account see Chittenden, Circ. 29, Div. Ent., U. S. Dept. Agric., 1898.

Exhibit: Adult and figure.

THE PEAR PSYLLA.

Psylla pyri Linn.

For general accounts see Slingerland, Bul. 44, Cornell Univ. Agr. Expt. Sta., 1892; Marlatt, Circ. 7, Div. Ent., U. S. Dept. Agric., 1895.

Exhibit: Figure.

THE PEAR BLISTER MITE.

Eriophyes pyri Pagenst.

For detailed account see Slingerland, Bul. 61, Cornell Univ. Agr. Expt. Sta., pp. 317–328, figures, 1893.

Exhibit: Work and figure.

INSECTS INJURIOUS TO GRAPE.

For the more important grape insects see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., 1898; Saunders, Insects Injurious to Fruit, 2d edition, pp. 227–302, 1900; Bruner, Nebr. State Hortic. Soc. Rept. f. 1895, pp. 69–162, 1896.

INJURING THE ROOTS.

THE TILE-HORNED PRIONUS.

Prionus imbricornis Linn.

For general account of *Prionus* species see Lugger, 5th Rpt. St. Ent. Minn., pp. 110–111, 1899.

Exhibit: Adult.

THE GRAPEVINE ROOT-BORER.

Memythrus polistiformis Harr.

(Formerly *Sciapteron.*)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 55–57, 1899.

Exhibit: Figures.

INJURING LEAVES AND ROOTS.

GRAPE PHYLLOXERA.

Phylloxera vastatrix Planch.

For general article see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 4–9, figs., 1898.

Exhibit: Work and figure.

INJURING THE STEMS AND BRANCHES.

COTTONY MAPLE SCALE.

Pulvinaria innumerablis Rathv.

(Foot-plants: Alder, apple, box-elder, elm, grape, linden, maples, pear, willow, etc. See under "More Important Scale Insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 134–135, 1903; Howard, Bul. 22, n. s., Div. Ent., U. S. Dept. Agric., pp. 8–16, figs. 4, 1900.

Exhibit: Infested twig.

THE GRAPE SCALE.

Aspidiotus uvæ Comst.

(Food-plants: Ampelopsis, grape, hickory.)

For bibliography see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 280, 1903.

Exhibit: Infested twig.

THE APPLE TWIG-BORER.

Amphicerus bicaudatus Say.

For general account see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 11–13, figure, 1898.

Exhibit: Adult and figure.

RED-SHOULDERED TWIG-BORER.

Sinoxylōn basilare Say.

For general account see Lugger, 5th Rpt. St. Ent. Minn., pp. 70–72, 1899.

Exhibit: Adult and figure.

THE SNOWY TREE-CRICKET.

Œcanthus niveus DeG.

For general account see Lugger, 3d Rpt. St. Ent. Minn., pp. 269–271, 1898.

Exhibit: Adult and figure.

ŒCANTHUS LATIPENNIS Riley.

For brief article see Lugger, 3d Rpt. St. Ent. Minn., p. 273. 1898.

Exhibit: Adult.

GRAPE-VINE ROOT-WORM.

Fidia viticida Walsh.

For life history and bibliography see Felt, Bul. 72, N. Y. St. Museum, 1903, 55 pp., with colored plate.

Exhibit: Adult and figure.

GRAPE-VINE FIDIA.

Fidia longipes Mels.

Exhibit: Adult.

INJURING THE LEAVES.

ACHEMON SPHINX.

Pholus achemon Dru.

(Formerly *Philampelus.*)

For general account see Lugger, 4th Rpt. State Ent. Minn., pp. 38–40, 1899.

Exhibit: Larva and adult.

GRAPE-VINE HOG-CATERPILLAR.

Ampelophaga myron Cram.

For general account see Lugger, 4th Rpt. State Ent. Minn., pp. 42–45, 1899.

Exhibit: Larva and adult.

ABBOT'S SPHINX.

Sphecodina abbotii Swaine.

(Formerly *Thyreus.*)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 32–33, 1899.

Exhibit: Larva and adult.

LARGE BEAUTIFUL WOOD NYMPH.

Euthisanotia grata Fabr.

(Formerly *Eudryas.*)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 69–71, 1899.

Exhibit: Larva and adult.

SMALL BEAUTIFUL WOOD NYMPH.

Euthisanotia unio Hübn.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 71–72, 1899.

Exhibit: Larva and adult.

EIGHT-SPOTTED FORESTER.

Alypia octomaculata Fab.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 66–67, 1899.

Exhibit: Larva and adult.

SOCIAL GRAPE CATERPILLAR.

Harrisina americana Guer.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 72–74, 1899.

Exhibit: Adult and figure.

GRAPE LEAF-FOLDER.

Desmia funeralis Hübn.

For general account see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 16–17, 1898.

Exhibit: Larva, adult, and work.

GRAPE-VINE PLUME-MOTH.

Oxyptilus periscelidactylus Fitch.

For general article see Lugger, 4th Rpt. St. Ent. Minn., pp. 221–222, 1899; for bibliography and article see Lintner, 12th Rpt. St. Ent. N. Y., pp. 218–222, 1897.

Exhibit: Larva and adult.

GRAPE-VINE SAWFLY.

Blennocampa pygmaea Say.

For general articles see Harris, Insects Injurious to Vegetation, pp. 522–525; Beach, Lowe and Stewart, Bul. 170, N. Y. Agric. Expt. Sta., p. 417, 1899.

Exhibit: Adult and figure.

GRAPE-VINE FLEA-BEETLE.

Haltica chalybea Illig.

For general articles see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 13–14, 1898; Slingerland, Bul. 157, Cornell Univ. Agr. Expt. Sta. N. Y., 1898. For additional food plants see Lugger, 5th Rpt. St. Ent. Minn., pp. 157–159, 1899.

Exhibit: Adult and figure.

THE GRAPE-VINE COLASPIS.

Colaspis brunnea Fab.

For general article see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 13–14, 1903.

Exhibit: Adult.

THE VARIED ANOMALA.

Anomala varians Burm.

Exhibit: Adult.

THE GRAPE-VINE LEAF-HOPPER.

Typhlocyba comes Say.

For general article see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 18–20. 1898, under *Typhlocyba vitifex.* For full life history and general account see Slingerland, Bul. 215, Cornell Univ. Agr. Expt. Sta., 1904.

Exhibit: Adult and figure.

THE WAVED SHARP-SHOOTER.

Oncometopia undata Fab.

(Formerly *Proconia.*)

For general article see Lugger, 6th Rpt. St. Ent. Minn., pp. 136–137, 1900.

Exhibit: Adult.

INJURING THE FRUIT.

THE GRAPE-SEED WORM.

Isosoma vitis Saunders.

For general account see Saunders. Insects Injurious to Fruits. 2d ed., pp. 296–297, 1900.

Exhibit: Adult.

THE GRAPE FRUIT-MOTH.

Polychrosis botrana Schiff.

(Formerly *Eudemis.*)

For general article see Marlatt. Farmers' Bul. 70, U. S. Dept. Agric., pp. 20–22, 1898.

Exhibit: Adult and figure.

THE GRAPE SEED-WEEVIL.

Craponius inæqualis Say.

For general accounts see Saunders. Insects Injurious to Fruits. 2d ed., pp. 300-301, 1900; Lintner, 9th Rpt. N. Y. St. Ent., pp. 364–365. 1893.

Exhibit: Adult and figure.

INSECTS INJURIOUS TO COTTON.

For general articles on cotton insects see Howard. The Cotton Plant, Bul. 33, Office Expt. Sta., U. S. Dept. Agric., pp. 317–350, 1896; Farmers' Bul. 47, U. S. Dept. Agric., 1897; Ashmead, Insect Life, v. VII, pp. 25–29, 240–247, 1894, and pp. 320–326, 1895.

NOTABLY INJURIOUS.

COTTON BOLLWORM; CORN-EAR WORM.

Heliothis obscura Fab.

(Formerly called *H. armiger.* Larvæ feed on bolls of cotton, ears of corn. tobacco buds, beans, and in tomatoes; also cut off young plants of various garden crops.)

For full life history and general account see Quaintance, Farmers' Bul. 191, U. S. Dept. Agric., 1904.

Exhibit: Larva, pupa, adult, work in cotton bolls, and illustrations of different stages, and work on various plants. Parasite exhibited: *Archytas piliventris;* adult, pupa, and figure. Enemies exhibited: *Calosoma lugubre*, *C. Sayi*, *C. scrutator* Fab., *Polistes annularis*, and *P. rubiginosus* Lep.

MEXICAN COTTON BOLL WEEVIL.

Anthonomus grandis Boh.

(Breeds in and destroys bolls.)

For full life history and general account see Hunter and Hinds, Bul. 45, Div. Ent., U. S. Dept. Agric., 1904; also Hunter, Farmers' Bul. 189, 1904.

Exhibit: Life history (larvæ, pupæ, adults, injured cotton bolls, with stages present in bolls, and uninjured bolls); illustrations and map showing distribution in United States.

THE COTTON WORM.

Alabama argillacea Hübn.

(Formerly called *Aletia xylina*. Larvæ feed on the leaves.)

For life history and general account see Howard, The Cotton Plant, Bull. 33, Office Expt. Stations, U. S. Dept. Agric., pp. 320–328, 1896.

Exhibit: Larva, pupa, cocoon, adult, and figure.

RED BUG; COTTON-STAINER.

Dysdercus suturellus H.-Schf.

(Punctures boll and seeds, aborting them and staining fibers an indelible red or yellow color.)

Exhibit: Nymph, adult, work, and figure.

GLASSY-WINGED SHARPSHOOTER.

Homalodisca coagulata Say.

(Punctures stalk, leaves, and flowers; oviposits in forms and squares; very abundant.

Exhibit: Nymph, adult, and figure.

COTTON APHIS.

Aphis gossypii Glover.

(Punctures leaves and young bolls; late in season causes falling of young bolls.)

See Chittenden, Bull. 43, Div. Ent., U. S. Dept. Agric., pp. 58–61, 1903.

Exhibit: Adult, work, and figure.

LEAF-CUTTING ANT.

Atta fervens Say.

(Cleans up plants, cotton worms, and pupæ.)

Exhibit: Adult.

THE AMERICAN LOCUST.

Schistocerca americana Dru.

For life history and general account see Howard, Insect Life, v. VII, pp. 220–229, 1894; Morgan, Bull. 30, n. s., Div. Ent., U. S. Dept. Agric., p. 27, 1901.

Exhibit: Nymph and adult.

THECLA PŒAS Hubn.

(Larvæ feed on or bore into bolls, and also feed on leaves.)

For brief account see Mally, Bul. 29, Div. Ent., Dept. Agric., pp. 29–30, 1893.

Exhibit: Adult and work.

COTTON SNOUT-MOTH.

Platynota sentana Clem.

(Attacks forms and squares; afterwards feeds on leaves.)

Exhibit: Adult.

RASPBERRY SNOUT-MOTH.

Platynota rostrana Walk.

(Larvæ bore into young bolls.)

Exhibit: Adult.

COTTON-BOLL CUTWORM.

Prodenia ornithogalli Guen.

(Works as the boll-worm; feeds on bolls and squares.)

For life history, general account, and distribution see Chittenden, Bul. 27, n. s., Div. Ent. U. S. Dept. Agric., pp. 64–71, 1901.

Exhibit: Adult.

SHAGREENED CUTWORM.

Feltia malefida Guen.

(Larvæ destroy young plants.)

Exhibit: Adult.

OCCASIONALLY INJURIOUS.

THICK-THIGHED WALKING-STICK.

Diapheromera femorata Linn.

For general account of life history see Howard, The Insect Book, pp. 323–325; fig. 214; pl. 32, fig. 13, 1901.

Exhibit: Adult.

LEAF-PALPUS CRICKET.

Phyllopalpus pulchellus Uhl.

(Feeds on petals, corolla, and pollen.)

Exhibit: Adult.

AGITATING CRICKET.

Hapithus agitator Uhl.

Exhibit: Adult.

BANDED CRICKET.

Nemobius fasciatus DeG.

EXHIBIT: Adult.

TETTIGIDEA LATERALIS Say.

EXHIBIT: Adult.

CONE-HEADED LOCUST.

Conocephalus obtusus Burm.

(Feeds on leaves, eating large pieces out of side and gnawing holes through the middle.)

EXHIBIT: Adult.

OBSCURE GRASSHOPPER.

Acridium obscurum Burm.

(Feeds upon leaves, and sometimes almost defoliates branches.)

For brief notices see Ashmead, Insect Life, v. VII, p. 26, 1894; Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., pp. 27–28, 1901.

EXHIBIT: Adult.

THREE-SPOTTED SOLDIER-BUG.

Euschistus tristigmus Say.

(Common in cotton; punctures terminal shoots.)

EXHIBIT: Adult.

CHARIESTERUS ANTENNATOR Fab.

(Feeds on juices of cotton plants.)

EXHIBIT: Adult.

SOUTHERN LEAF-FOOTED PLANT-BUG.

Leptoglossus phyllopus Linn.

(Punctures buds and young bolls.)

For life history and general account see Chittenden, Bul. 19, n. s., Div. Ent. U. S. Dept. Agric., pp. 46–48, 1899.

EXHIBIT: Adult.

METAPODIUS FEMORATUS Fab.

(Attacks cotton worms and also punctures young bolls.)

EXHIBIT: Adult.

CALOCORIS RAPIDUS Say.

(Punctures buds and young bolls; causes bolls to "flare" and drop.)

EXHIBIT: Adult.

AULACIZES IRRORATA Fab.

(Common; feeding on stalk, etc.)

EXHIBIT: Adult.

SIX-SPOTTED TREE-HOPPER.

Cicadula sexnotata Fall.

(Feeds on cotton stalks, etc.)

EXHIBIT: Adult.

SCOLOPS SULCIPES Say.

(Punctures stems.)

Exhibit: Adult.

ENTILIA SINUATA Fab.

(Punctures terminal shoots.)

For general account see Howard, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., pp. 75–78, 1901.

Exhibit: Adult.

THE PHYLLIRA TIGER-MOTH.

Apantesis phyllira Dru.

(Sometimes locally almost as injurious as the cotton worm.)

Exhibit: Adult.

GREAT LEOPARD MOTH.

Ecpantheria deflorata Fab.

(Formerly *E. scribonia* Stäl.)

Exhibit: Adult.

ABBOT'S BAGWORM.

Oiketicus abbottii Grote.

Exhibit: Adult.

SALT-MARSH CATERPILLAR.

Estigmene acræa Dru.

(Formerly *Leucarctia.*)

For short account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 43–44, fig. 41, 1903.

Exhibit: Adult.

YELLOW-BEAR CATERPILLAR.

Diacrisia virginica Fab.

For general account see Lugger, 4th Rept. State Ent. Minn., pp. 79–81, fig. 78, 1899.

Exhibit: Adult.

IO MOTH.

Automeris io Fab.

For general account see Lugger, 4th Rept. State Ent. Minn., pp. 126–129, fig. 130, and pl. 16, fig. 129, 1899.

Exhibit: Adult.

MARGINED LEAF-CHAFER.

Anomala marginata Fab.

For bibliography and general account see Lintner, 10th Rpt. State Ent. N. Y., pp. 411–413, 1895.

Exhibit: Adult.

MELANCHOLY SAPCHAFER

Euphoria melancholica Gory.

(Frequents flowers for nectar and sap: exceptionally eats into bolls.)

Exhibit: Adult.

THE LIVID WIREWORM.

Monocrepidius lividus DeG.

(Feeds on leaves, blossoms, and squares.)

Exhibit: Adult.

LEMA SEX-PUNCTATA Ol.

(Adult feeds on leaves.)

For notice of occurrence on cotton see Ashmead, Insect Life, v. VII, p. 247, 1894.

Exhibit: Adult.

THE SOUTHERN CORN LEAF-BEETLE.

Myochrous denticollis Say.

For general account see Webster, Bull. 26, n. s., Div. Ent., U. S. Dept. Agric., p. 87, 1900.

Exhibit: Adult.

CRYPTOCEPHALUS CALIDUS Suff.

For notice of occurrence on cotton see Ashmead, Insect Life, v. VII, p. 247, 1894.

Exhibit: Adult.

TYPOPHORUS VIRIDICYANEUS Crotch.

(Beetle feeds on young leaves.)

Exhibit: Adult.

NODONOTA TRISTIS Ol.

(Gnaws bolls, causing them to drop.)

For list of food-plants see Chittenden, Bull. 7, n. s., Div. Ent., U. S. Dept. Agric., p. 61, 1897; for general article see Lugger, 5th Rept. State Ent. Minn., p. 146, 1899.

Exhibit: Adult.

ELONGATE FLEA-BEETLE.

Systena elongata Fab.

(On bolls.)

For notice of occurrence on cotton see Ashmead, Insect Life, v. VII, p. 247, 1894.

Exhibit: Adult.

THE EGG-PLANT FLEA-BEETLE.

Epitrix fuscula Cr.

For general account see Chittenden, Bull. 19, n. s., Div. Ent., U .S. Dept. Agric., pp. 87–89, 1899.

Exhibit: Adult.

BENEFICIAL INSECTS COLLECTED ON COTTON.

For general list of beneficial insects taken on cotton see Ashmead, Insect Life, v. VII, 1895.

CHRYSOPA ATTENUATA Walk.

Exhibit: Adult.

PERITHEMIS DOMITIA Dru.

EXHIBIT: Adult.

CAROLINA REAR HORSE.

Stagmomantis carolina Burm.

EXHIBIT: Egg mass and adult.

SINEA DIADEMA Fab.

(Attacks cotton worms and is destructive to other small caterpillars and aphides.)

EXHIBIT: Adult.

WHEEL-BUG.

Arilus cristatus Linn.

(Observed to prey on the cotton worm. Formerly called *Prionidus.*)

EXHIBIT: Adult.

ZELUS BILOBUS Say.

(Attacks cotton worm.)

EXHIBIT: Nymph and adult.

APIOMERUS CRASSIPES Fab.

(Observed to attack cotton worms.)

EXHIBIT: Adult.

PHYMATA FASCIATA Gray.

(Attacks cotton worms: also Diptera.)

EXHIBIT: Adult.

SIX-SPOTTED TIGER BEETLE.

Cicindela sex-guttata Fab.

EXHIBIT: Adult.

CAROLINA TIGER BEETLE.

Tetracha carolina Linn.

(Feeds occasionally upon cotton worms.)

EXHIBIT: Adult.

SUBTERRANEAN GROUND BEETLE.

Scarites subterraneus Fab.

EXHIBIT: Adult.

PTEROSTICHUS PERMUNDUS Say.

EXHIBIT: Adult.

HELLUOMORPHA TEXANA Lec.

EXHIBIT: Adult.

GALERITA ATRIPES Lec.

EXHIBIT: Adult.

CALLIDA DECORA Fab.

EXHIBIT: Adult.

COCCINELLA SANGUINEA Linn.

(Attacks cotton aphis.)
Exhibit: Adult.

COCCINELLA OCULATA Fab.

Exhibit: Adult.

TWICE-STABBED LADYBIRD.

Chilocorus bivulnerus Muls.

(Attacks cotton Aleyrodes.)
Exhibit: Adult.

COLLOPS QUADRIMACULATUS Fab.

(Feeds on pollen, and probably on small insects.)
Exhibit: Adult.

ROBBER FLY.

Erax lateralis Macq.

(Observed to catch bollworm moths on the wing.)
Exhibit: Adult.

ASILUS SERICEUS Say.

(Observed to catch moths on the wing.)
Exhibit: Adult.

MESOGRAPTA POLITA Say.

(Feeds on aphids.)
Exhibit: Adult.

COTTON-WORM TACHINA FLY.

Frontina aletiæ Riley.

Exhibit: Adult.

HOLCOCEPHALA ABDOMINALIS Say.

Exhibit: Adult.

DIOGMITES DISCOLOR Loew.

Exhibit: Adult.

LAPHRIA THORACICA Fab.

Exhibit: Adult.

ATOMOSIA PUELLA Wied.

Exhibit: Adult.

ROBBER FLY.

Proctacanthus milberti Macq.

(Observed to attack cotton worm.)
Exhibit: Adult.

ISODONTIA PHILADELPHICA Lep.

(Preys upon crickets.)
Exhibit: Adult.

AMMOPHILA PICTIPENNIS Walsh.

(Preys on caterpillars.)

EXHIBIT: Adult.

POLISTES RUBIGINOSUS Lep.

EXHIBIT: Adult.

COMPSOMERUS QUADRINOTATA Fab.

EXHIBIT: Adult.

LYSIPHLEBUS TESTACEIPES Cress.

(Cotton aphis parasite: "Fairly cleaned cotton of aphids.")

EXHIBIT: Adult.

OPHION BILINEATUS Say.

EXHIBIT: Adult.

SPILOCRYPTUS NUNCIUS Say.

(Bred from cotton worm.)

EXHIBIT: Adult.

SYNTOMOSPHYRUM ESURUS Riley.

(Bred from cotton worm.)

EXHIBIT: Adult.

EUPLECTRUS COMSTOCKII How.

(Bred from cotton worm and boll worm.)

EXHIBIT: Adult.

INSECTS INJURIOUS TO INDIAN CORN.

Treating of injuries to seed in ground and roots see Forbes, 18th Rept. St. Ent. Ill., pp. 7–171, Pls. I–XV, 1894.

For general articles see Webster, 35th Ann. Rept. Ind. St. Bd. Agric. f. 1885, pp. 180–215, 1886; Bruner, Rpt. Nebr. St. Bd. Agr. f. 1891, pp. 240–309, 1892.

INJURING THE PLANTED SEED.

THE SEED-CORN MAGGOT.

Pegomya fusciceps Zett.

(Formerly *Pegomyia zeæ* Riley.)

For general articles see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 84–92, 1902; Forbes 18th Rpt. St. Ent. Ill., pp. 16–19, 1894.

EXHIBIT: Pupa, adult, and work.

SEED-CORN AGONODERUS.

Agonoderus pallipes Fab.

For general account see Forbes, 18th Rept. St. Ent. Ill., pp. 12–14, 1894.

EXHIBIT: Adult and work.

LITTLE BLACK ANT.

Prenolepis imparis Say.

(Adults eat sprouting corn; also called *P. nitens* Mayr., which is a European variety of the species.)

EXHIBIT: Adult.

THE SMALL YELLOW ANT.

Solenopsis debilis Mayr.

For general article see Forbes, 18th Rept. St. Ent. Ill., pp. 9–11, 66, 1894.

EXHIBIT: Adult and figure.

THE VAGABOND CRAMBUS.

Crambus vulgivagellus Clem.

For general account see Lintner, 1st Rept. St. Ent. N. Y., pp. 127–157, 1882; Felt. Bul. 64, Cornell Univ. Agr. Expt. Sta., pp. 69–71, 1894.

EXHIBIT: Adult and figure.

THE CORN-ROOT WEBWORM.

Crambus zeellus Fern.

(Larvæ feed on roots; when full grown form a webbed cocoon near base of stalk.)

For general account see Forbes, 14th Rpt. St. Ent. Ill., pp. 12–17, 1885.

EXHIBIT: Pupa, cocoon, and adult.

INJURING THE ROOTS AND SEEDS.

THE CORN-ROOT APHIS.

Aphis maidis-radicis Forbes.

For detailed account see Forbes, 18th Rpt. St. Ent. Ill., pp. 58–85, 1894.

EXHIBIT: Adult and figure.

WHITE GRUB; MAY BEETLE.

Lachnosterna fusca Fröh.

For account of white grubs injuring corn see Forbes, 18th Rept. St. Ent. Ill., pp. 109–145, 1894.

EXHIBIT: Adult.

LACHNOSTERNA GIBBOSA Burm.

For general account of white grubs see Forbes, 18th Rept. St. Ent. Ill., pp. 109–145, 1894.

EXHIBIT: Adult.

THE WHEAT WIREWORM.

Agriotes mancus Say.

For general account see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 77–78, 1901.

EXHIBIT: Adult and figure.

THE CORN WIREWORM.

Melanotus cribulosus Lec.

For injuries by wire-worms see Forbes, 18th Rept. St. Ent. Ill., pp. 27–51, 1894.

Exhibit: Adult and figure.

THE COMMON WIREWORM.

Melanotus communis Gyll.

For injuries by wire-worms see Forbes, 18th Rept. St. Ent. Ill., pp. 27–51, 1894.

Exhibit: Adult.

TWELVE-SPOTTED CUCUMBER-BEETLE.

Diabrotica duodecempunctata Oliv.

For general articles see Forbes, 18th Rept. St. Ent. Ill., pp. 146–154, 1894; Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 12–13, 1903; Quaintance, Bul. 26, n. s., Div. Ent., U. S. Dept. Agric., pp. 35–40, 1900.

Exhibit: Adult and figure. (See also, under "Injuring the Ears.")

THE NORTHERN CORN ROOT-WORM.

Diabrotica longicornis Say.

For general account see Forbes, 18th Rept. St. Ent. Ill., pp. 154–165, 1894.

Exhibit: Adult and figure.

INJURING THE YOUNG PLANT.

CORN BILL-BUGS.

For general articles on corn bill-bugs see Forbes, 16th Rept. St. Ent. Ill., pp. 58–74, 1890; Bul. 79, Ill. Agr. Expt. Sta., 27 pp. 1902.

THE CLAY-COLORED BILL-BUG.

Sphenophorus æqualis Linn.

(Treated as *S. ochreus* Lec, by Forbes, l. c.)

Exhibit: Adult and figure.

NORTHERN CORN BILL-BUG.

Sphenophorus zeæ Walsh.

(Generally called by authors *S. sculptilis.*)

Exhibit: Adult and work.

THE TENACIOUS BILL-BUG.

Sphenophorus pertinax Oliv.

Exhibit: Adult.

THE BLUE-GRASS BILL-BUG.

Sphenophorus parvulus Gyll.

Exhibit: Adult.

THE CALLOUSED BILL-BUG.

Sphenophorus callosus Oliv.

Exhibit: Adult.

THE FALL ARMY WORM.

Laphygma frugiperda S. & A.

(Larvæ feed on leaves, burrow in young plants, and later leaves and forming ears are damaged.)

For full life history and bibliography see Chittenden, Bul. 29, n. s., Div. Ent. U. S. Dept. Agric. pp. 13–45, 1901.

Exhibit: Larva and adult.

THE ARGE TIGER MOTH.

Apantesis arge Dru.

For brief account see Bruner, Rept. Nebr. St. Bd. Agr. 1891, p. 244, 1892.

Exhibit: Larva, pupa, and adult.

YELLOW-BEAR CATERPILLAR.

Diacrisia virginica Fab.

For general account see Lugger, 4th Rept. State Entom. Minn., pp. 79–81, fig. 78, 1899.

Exhibit: Larva, cocoon, and adult.

SALT-MARSH CATERPILLAR.

Estigmene acræa Dru.

For short account see Chittenden, Bul. 43, Div. Ent. U. S. Dept. Agric., pp. 43–44, fig. 41, 1903.

Exhibit: Larva and adult.

THE SADDLE-BACK CATERPILLAR.

Sibine stimulea Clem.

For general account see Lugger, 4th Rept. State Ent. Minn., pp. 98–99, 1899.

Exhibit: Larva, pupa, cocoon, and adult.

THE DARK-SIDED CUTWORM.

Euxoa messoria Harr.

For general account see Riley, Rept. U. S. Dept. Agric., 1884, pp. 290–291, 1885.

Exhibit: Larva, adult, and figure.

THE BRONZED CUTWORM.

Nephelodes minians Guen.

For life history and partial bibliography see Lintner, 1st Rept. St. Ent. N. Y., pp. 99–110, 1882; Riley, Rept. U. S. Dept. Agric., 1890, pp. 244–246, 1891.

Exhibit: Adult.

THE W-MARKED CUTWORM.

Noctua clandestina Harr.

For general account see Slingerland, Bul. 104, Cornell Univ. Agr. Expt. Sta., pp. 571–574, 1895.

Exhibit: Larva and adult.

THE SPOTTED CUTWORM.

Noctua c-nigrum Linn.

For general account and life history see Chittenden, Bul. 27, n. s., Div. Ent. U. S. Dept. Agric., pp. 54–58, 1901.

Exhibit: Larva, pupa, adult, and figure.

THE VARIEGATED CUTWORM.

Peridroma saucia Hübn.

For general bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent. U. S. Dept. Agric., pp. 46–64, 1901.

Exhibit: Adult and figure.

THE GLASSY CUTWORM.

Hadena devastatrix Brace.

For general account see Riley, Rept. U. S. Dept. Agric. 1884, pp. 296–297, 1885.

Exhibit: Adult.

THE BLACK CUTWORM.

Agrotis ypsilon Rott.

For general account see Riley, Rept. U. S. Dept. Agric. 1884, pp. 294–295, 1895.

Exhibit: Larva, adult and figure.

WESTERN STRIPED CUTWORM.

Feltia herilis Grote.

For short account see Riley, 1st Rpt. St. Ent. Mo., pp. 81–82, 1869; Forbes: 16th Rpt. St. Ent. Ill., p. 89, 1894.

Exhibit: Larva and adult.

THE DINGY CUTWORM.

Feltia subgothica Haw.

For general articles see Chittenden, Yearbook, U. S. Dept. Agric., 1898, p. 257. Slingerland, Bul. 104, Cornell Univ. Agr. Expt. Sta., pp. 574–579, 1895.

Exhibit: Larva, adult and figure.

INJURING THE STALK.

THE SPINDLE WORM.

Achatodes zeæ Harr.

For brief accounts see Harris, Ins. Inj. to Veg., Flint Ed., pp. 438–439, 1862; Webster, 35th Ann. Rept. Ind. St. Bd. Agric., f. 1885, p. 193, 1886.

Exhibit: Adult and work.

SMALLER CORN STALK-BORER.

Elasmopalpus lignosellus Zell.

For life-history and general account see Chittenden, Bul. 23, n. s., Div. Ent. U. S. Dept. Agric. pp. 17–22, 1900.

Exhibit: Adult work and cocoon.

THE STALK BORER.

Papaipema nitela Guen.

(Formerly *Gortyna* and *Hydræcia.*)

For general account see Bird, Can. Ent., v. XXX, pp. 127–128, 1898; Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 11–12, fig. 2, 1902.

Exhibit: Adult.

CORN STALK-BORER; SUGAR-CANE BORER.

Diatræa saccharalis Fab.

For full life-history and general account see Howard, Insect life, v. IV, pp. 95–103, 1891.

Exhibit: Eggs, larva, pupa, adult, and work.

INJURING THE LEAVES.

THE LESSER LOCUST.

Melanoplus atlanis Riley.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 178–183, pl. 12, fig. 7, 1897; Riley, Bul. 25, Div. Ent. U. S. Dept. Agric. pp. 26–27, 1891.

Exhibit: Adult.

THE TWO-STRIPED LOCUST.

Melanoplus bivittatus Say.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 363–368, pp. 24, fig. 5, 1897; Riley, l. c., pp. 31–32.

Exhibit: Adult.

THE DIFFERENTIAL LOCUST.

Melanoplus differentialis Thos.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 349–354, pl. 23, figs. 3 and 4, 1897; also Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., pp. 7–26, 1901.

Exhibit: Adult.

RED-LEGGED LOCUST.

Melanoplus femur-rubrum DeG.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 278–285, pl. 1, fig. h., pl. 19, figs. 1–4, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 27–28, 1891.

Exhibit: Adult.

THE ROCKY-MOUNTAIN LOCUST.

Melanoplus spretus Thos.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 184–190, pl. 12, fig. 8, 1897; also Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 7–26, 1891.

Exhibit: Adult.

THE AMERICAN LOCUST.

Schistocerca americana Dru.

For life history and general account, Howard, Insect Life, v. VII, pp. 220–229, 1894; also Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., p. 27, 1901.

Exhibit: Adult.

THE CORN APHIS.

Aphis maidis Fitch.

For general account see Forbes, 13th Rept. St. Ent. Ill., pp. 43–50, 1884.

Exhibit: Figure.

THE BARRED-WINGED ONION MAGGOT.

Chætopsis ænea Wied.

For general accounts see Howard, Insect Life, v. VII, pp. 352–354, 1895; Pettit, Bul. 200, Mich. Agr. Exp. Sta., pp. 206–208, 1902.

Exhibit: Puparium and adult.

THE CHINCH BUG.

Blissus leucopterus Say.

(Injures cane, corn, oats, rye, wheat, etc.)

For bibliography, 1786–1888, see Forbes, App. to 16th Rept. St. Ent. Ill., pp. 1–102, 1894.

For general articles see Forbes, 16th Rept. St. Ent. Ill., pp. 1–57, 1894; Webster, Bul. 15, n. s., Div. Ent., U. S. Dept. Agric., 82 pp. 1898.

Exhibit: Nymph, adult, and figure.

THE FODDER WORM.

Epizeuxis æmula Hübn.

(Lives especially on leaves of stored fodder.)

For general account see Packard, 5th Rept. U. S. Ent., Comm., pp. 843–844, 1890.

Exhibit: Larva, pupa, cocoon, adult, and work.

THE ARMY WORM.

Heliophila unipuncta Harv.

(Formerly *Leucania*.)

For bibliography and life history see Lintner, 12th Rept. St. Ent. N. Y., pp. 190–214, 1896.

Exhibit: Larva and adult.

THE CORN-FEEDING SYRPHUS-FLY.

Mesograpta polita Say.

For general account see Riley and Howard, Insect Life, v. I, pp. 5–8, 1888.

Exhibit: Puparia and adult.

THE STRIPED BLISTER BEETLE.

Epicauta vittata Fab.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 22–23, 1903.

Exhibit: Pupa, adult, and figure.

BLACK BLISTER BEETLE.

Epicauta pennsylvanica DeG.

(Feed on pollen and flower leaves.)

For brief account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 25, 1903.

Exhibit: Adult.

THE MARGINED BLISTER BEETLE.

Epicauta cinerea Forst.

For brief account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 24, 1903.

Exhibit: Adult.

INJURING THE POLLEN, SILK, AND EARS.

BOLLWORM; CORN-EAR WORM.

Heliothis obscura Fab.

(Formerly *H. armiger* Hübn; see special case.)

For life history and general account see Quaintance, Farmer's Bul. 191, U. S. Dept. Agric., 1904.

Exhibit: Adult.

THE BROWN FRUIT-CHAFER.

Euphoria inda Linn.

For life history and general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 67–74, 1899.

Exhibit: Adult and work.

THE ROSE-CHAFER.

Macrodactylus subspinosus Fabr.

For general article and life history see Smith, Bul. 82, N. J. Agric. Expt. Sta., 1891.

Exhibit: Adult and figure.

THE RUSTY-BROWN TORTRIX.

Platynota flavedana Clem.

(Larvæ feed in ears of green corn.)

For general account see Lugger, 4th Rept. St. Ent. Minn., pp. 231–239, 1899.

Exhibit: Pupa and adult.

INSECTS INJURING SUGAR CANE.

THE SUGAR-CANE PIN-BORER.

Xyleborus sacchari Hopk.

For notes, under name of *X. pubescens* Zim., see Riley and Howard, Insect Life, v. IV, p. 402, and v. V, p. 51, 1892.

Exhibit: Adult, work, and figure.

HAWAIIAN SUGAR-CANE BORER.

Sphenophorus obscurus Boisd.

For life history and general account see Riley and Howard, Insect Life, v. I, pp. 185–189, 1888.

Exhibit: Adult and figure.

THE SUGAR-CANE BEETLE.

Ligyrus rugiceps Lec.

For general account see Howard, Insect Life, v. I, pp. 11–13, 1888.

Exhibit: Adult and work.

CORN STALK-BORER; SUGAR-CANE BORER.

Diatræa saccharalis Fab.

For full life history and general account see Howard, Insect Life, v. VI, pp. 95–103, 1891.

Exhibit: Larva, pupa, adult, and work.

INSECTS INJURIOUS TO RICE.

THE RICE WEEVIL.

Calandra oryza Linn.

For general account see Chittenden, Farmers' Bul. 45, rev. ed., U. S. Dept. Agric., pp. 5–6, 1897.

Exhibit: Adult and figure.

THE RICE GRUB.

Chalepus trachypygus Burm.

For general article see Riley, Rpt. U. S. Dept. Agric., 1881 pp. 128–129, 1882.

Exhibit: Adult and figure.

THE RICE STALK-BORER.

Chilo plejadellus Zinck.

For general article under *Chilo oryzællus* see Riley, Rpt. U. S. Dept. Agric. f. 1881, pp. 133–135, 1882.

Exhibit: Larva, adult, work, figure and the parasite *Phora aletiæ* Comst.

THE RICE WATER-WEEVIL.

Lissorhoptrus simplex Say.

For general article see Riley, Rpt. U. S. Dept. Agric. f. 1881, pp. 130–133, 1882.

Exhibit: Adult and figure.

THE FALL ARMY WORM.

Laphygma frugiperda S. & A.

For full life history and bibliography see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 13–45, 1901.

Exhibit: Larva, pupa, adult, and figure.

INSECTS INJURIOUS TO GRASSES.

APANTESIS NAIS Dru.

(Formerly *Arctia.*)

For account see Beutenmüller, "Cat. Lep. N. Y.," Ann. Acad. N. Y., p. 206, 1890.

Exhibit: Adult.

GRANULATED CUTWORM.

Feltia annexa Fr.

For general account see Riley, Rept. U. S. Dept. Agric., 1884, pp. 291–292, 1885. For description and stages see French, Can. Ent., v. XIV, pp. 207–210, 1882.

Exhibit: Adult and figure.

HOMOPTERA EDUSA Dru.

Exhibit: Larva, pupa, and adult.

NORTHERN GRASS WORM.

Drasteria erechtea Cram.

For general account see Slingerland, Insect Life, v. V, pp. 87–88, 1892.

Exhibit: Larva, pupa, adult, and work.

THE ARMY WORM.

Heliophila unipuncta Harv.

(Formerly *Leucania*).

For bibliography and life history see Lintner, 12th Rept. St. Ent. N. Y., pp. 190–214, 1896.

Exhibit: Larva, pupa, adult, and figure.

THE SALT-MARSH CATERPILLAR.

Estigmene acræa Dru.

(Formerly called *Leucarctia.*)

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 43–44, 1903.

Exhibit: Larva and adult.

FALL ARMY WORM.

Laphygma frugiperda S. & A.

For full bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 40–45, 1901.

Exhibit: Larva, pupa, adult, and figure.

THE ISABELLA TIGER MOTH.

Isia isabella S. & A.

(Formerly *Pyrrharctia.*)

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 44–45, 1903.

Exhibit: Larva, cocoon, adult and figure.

THE VAGABOND CRAMBUS.

Crambus vulgivagellus Clem.

For general accounts see Lintner, 1st Rept. St. Ent. N. Y., pp. 127–151, 1882; Felt, Bul. 64, Cornell Univ. Agric. Expt. Sta., pp. 69–71, 1898.

Exhibit: Eggs, adult, work, figure, and parasite *Lampronotus frigida* Cr.

THE SPOTTED CUTWORM.

Noctua c-nigrum Linn.

For general account and life history see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 54–58, 1901.

Exhibit: Pupa and adult.

WHITE GRUB; MAY BEETLE.

Lachnosterna fusca Fröh.

For account of white grubs see Forbes, 18th Rept. St. Ent. Ill., pp. 109–145, 1894.

Exhibit: Adult.

WHITE GRUB; JUNE BEETLE.

Lachnosterna arcuata Smith.

For general account see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 74–76, 1901.

Exhibit: Adult and figure.

THE DISTENDED MAY BEETLE.

Lachnosterna farcta Lec.

For short notices see Comstock, Rept. U. S. Dept. Agric. 1879, pp. 247–248, Pl. V, fig. 5, 1880, and Howard, Bul. 22, n. s., Div. Ent., U. S. Dept. Agric., p. 107, 1900.

Exhibit: Adult.

THE BLUE-GRASS BILL-BUG.

Sphenophorus parvulus Gyll.

For article see Forbes, 16th Rept. St. Ent. Ill., pp. 63, 65, 1894.

Exhibit: Adult.

THE LESSER LOCUST.

Melanoplus atlanis Riley.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 178–183, pl. 12, fig. 7, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 26–27, 1891.

Exhibit: Adult.

THE CAROLINA LOCUST.

Dissosteira carolina Linn.

For short account see Forbes and Hart, Bul. 60, Ill. Agric. Expt. Sta., pp. 479–480, 1900.

Exhibit: Nymph and adult.

THE TIMOTHY PLANT-BUG.

Oncognathus binotatus Fabr.

For general account see Howard, Insect Life, v. V, pp. 90–92, 1892.

Exhibit: Adult.

THE GREATER WHEAT-STEM MAGGOT.

Meromyza americana Fitch.

For general article see Webster, Bul. 42, Div. Ent., U. S. Dept. Agric., pp. 43–51, 1903.

Exhibit: Adult and figure.

LEATHER JACKET; MEADOW WORM.

Tipula bicornis Loew.

For general account see Forbes, 16th Rept. St. Ent. Ill., pp. 78–83, 1890.

Exhibit: Adult and figure.

INSECTS INJURIOUS TO ALFALFA.

THE VARIEGATED CUTWORM.

Peridroma saucia Hübn.

For general bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent. U. S. Dept. Agric., pp. 46–64, 1901.

Exhibit: Larva and adult.

THE FALL ARMY WORM.

Laphygma frugiperda S. & A.

For full bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent. U. S. Dept. Agric., pp. 40–45, 1901.

Exhibit: Larva and adult.

THE ALFALFA WEBWORM.

Loxostege commixtalis Walk.

(Formerly known as *L. cereralis* Zell.)

For account of *Loxostege* sp. attacking alfalfa see Insect Life, v. VI, pp. 36, 1893.

Exhibit: Adult.

THE TWO-STRIPED LOCUST.

Melanoplus bivittatus Say.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 363–368, pl. 24, fig. 5, 1897.

Exhibit: Adult and figure.

THE DIFFERENTIAL LOCUST.

Melanoplus differentialis Thos.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 349–354, pl. 23, figs. 3 and 4, 1897; also Morgan, Bul. 30, n. s., Div. Ent. U. S. Dept. Agric., pp. 7–26, 1901.

Exhibit: Adult and figure.

THE ROCKY-MOUNTAIN LOCUST.

Melanoplus spretus Thos.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 184–190, pl. 12, fig. 8, 1897.

Exhibit: Adult.

THE AMERICAN LOCUST.

Schistocera americana Dru.

For life history and general account see Howard, Insect Life, v. VII, pp. 220–229, 1897; also Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., p. 27, 1901.

Exhibit: Adult.

THE CLOVER-SEED CHALCIS-FLY.

Bruchophagus funebris How.

For general account see Hopkins, Bul. 6, n. s., Div. Ent. U. S. Dept. Agric., p. 73, 1896, and Bul. 17, n. s., p. 45, 1898; Titus, Bul. 44, pp. 77–80, 1904.

Exhibit: Adult and work.

INSECTS INJURIOUS TO SMALL GRAINS.

For general articles see Howard, Tech. Ser. 2, Div. Ent. U. S. Dept. Agric., 24 pp., 1896; Marlatt, Farmers' Bul. 132, U. S. Dept. Agric., 38 pp., 1901; Webster, Bul. 42, Div. Ent., U. S. Dept. Agric., 62 pp., 1903.

THE LESSER LOCUST.

Melanoplus atlanis Riley.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 178–183, pl. 12, fig. 7, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 26–27, 1891.

Exhibit: Nymph and adult.

THE RED-LEGGED LOCUST.

Melanoplus femur-rubrum DeG.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 278–285, pl. 1, fig. h; Pl. IX, figs. 1–4, 1897; Riley, Bul. 25, Div. Ent. U. S. Dept. Agric., pp. 27–28, 1891.

Exhibit: Nymph and adult.

THE ROCKY MOUNTAIN LOCUST.

Melanoplus spretus Thos.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 184–190, pl. 12, fig. 8, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 9–26, 1891.

Exhibit: Nymph, adult, and figure.

THE WESTERN CRICKET.

Anabrus purpurascens Uhl.

For detailed account see Packard, 2d Rept. U. S. Ent. Comm., pp. 163–178, 1879.

Exhibit: Adult.

THE CLEAR-WINGED LOCUST.

Camnula atrox Scudd.

For account of an allied species (*C. pellucida*) see Simpson, Circ. 53, Div. Ent., U. S. Dept. Agric., 1903.

Exhibit: Adult.

THE ARMY WORM.

Heliophila unipuncta Harv.

(Formerly *Leucania.*)

For bibliography and life history see Lintner, 12th Rept. St. Ent. N. Y., pp. 190–214, 1896.

Exhibit: Larva, pupa, adult, and figure.

FALL ARMY WORM.

Laphygma frugiperda S. & A.

For full bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 40–45, 1901.

Exhibit: Larva, pupa, and adult.

STALK BORER.

Papaipema nitela Guen.

(Bores in stems of various plants.)

For general account see Bird, Can. Ent., v. XXX, pp. 127–128, 1898.

Exhibit: Larva, pupa, adult, and work.

WHEAT-HEAD ARMY-WORM.

Heliophila albilinea Hübn.

For general account see Riley, 9th Rept. St. Ent. Mo., pp. 50–57, 18.

Exhibit: Pupa, adult, figure, and parasites: *Anomalon apicale* Cress., *Tachina anonyma* Riley.

NUTTALL'S BLISTER BEETLE.

Cantharis nuttalli Say.

For short article see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 27, 1903.

EXHIBIT: Adult.

THE CLAY-COLORED BILL-BUG.

Sphenophorus æqualis Lec.

(Treated as *S. ochreus* Lec. by authors.)

For articles on bill-bugs see Forbes, 16th Rept. St. Ent. Ill., pp. 58-74, 1890; Webster, Insect Life, v. II, pp. 132–134, 1889.

EXHIBIT: Adult.

THE GERMAN GRAIN-LOUSE.

Macrosiphum cerealis Kalt.

(Attacks barley, chess, meadow, orchard, and velvet grass, oats, rye, and wheat, feeding on ears, racemes, and other parts of plant.)

For general account see Pergande, Bul. 44, Div. Ent., U. S. Dept. Agric., pp. 18–21, 1904.

EXHIBIT: Figure.

THE ENGLISH GRAIN-LOUSE.

Macrosiphum granaria Buck.

(Attacks green foxtail, meadow, and orchard grass, oats, red-clover, red top, rye, wheat, and wild rye.)

For general account see Pergande, Bul. 44, Div. Ent., U. S. Dept. Agric., pp. 13–18, 1904.

EXHIBIT: Figure and work; parasite, *Lysiphlebus testaceipes* Cress. (figure); and enemies, *Anatis 15-punctata* Ol.; *Coccinella sanguinea* Linn.; *Hippodamia parenthesis* Say; *Podabrus tomentosus* Say; *Sphærophoria cylindrica* Say; *Syrphus americanus* Wied.

THE EUROPEAN GRAIN-LOUSE.

Siphocoryne avenæ Fabr.

(Attacks apple, burdock, celery, choke-cherry, dogwood, grasses, oats, rye, wheat, and other plants.)

For general account see Pergande, Bul. 44, Div. Ent., U. S. Dept. Agric., pp. 5–13, 1904.

EXHIBIT: Figure.

THE CHINCH BUG.

Blissus leucopterus Say.

(Injures cane, corn, oats rye, wheat, etc.)

For bibliography 1785-1888 see Forbes, App. to 16th Rept. St. Ent. Ill., pp. 1–102, 1894. For general articles see Forbes, 16th Rept. St. Ent. Ill., pp. 1–57, 1894; Webster, Bul. 15, n. s., Div. U. S. Dept. Agric., 82 pp., 1898.

EXHIBIT: Eggs, nymph, adult, and figure.

THE GRAIN LEAF-HOPPER.

Diedrocephalus flaviceps Riley.

For account of *D. mollipes* see Osborn & Ball, Bul. 34, Iowa Agric. Expt. Sta., p. 614, 1897.

Exhibit: Adult.

THE DESTRUCTIVE LEAF-HOPPER.

Cicadula exitiosa Uhl.

For general account see Comstock, Rept. U. S. Comm. Agric., 1879, pp. 191–193, 1880.

Exhibit: Adult.

THE WHEAT FALSE WORM.

Dolerus arvensis Say.

For general account see Riley and Marlatt, Insect Life, v. IV, pp. 171–172, 1891.

Exhibit: Adult and figure.

THE GRASS SAWFLY.

Pachynematus extensicornis Nort.

(Formerly *Nematus marylandicus.*)

For article under *N. marylandicus* see Riley and Marlatt, Insect Life, v. IV, pp. 174–177, 1891.

Exhibit: Adult and figure.

THE WESTERN GRAIN SAWFLY.

Cephus occidentalis Marl.

For short article see Riley and Howard, Insect Life, v. II, p. 286, 1890.

Exhibit: Adult, work and figure.

JOINT-WORMS.

For special articles to four following species see Howard, Tech. Ser. 2, Div. Ent., U. S. Dept. Agric., 24 pp., 1896; also Webster, Bul. 42, Div. Ent., U. S. Dept. Agric., 62 pp., 1903.

GREATER WHEAT-STRAW WORM.

Isosoma grande Riley.

Exhibit: Adult and figure.

BARLEY-STRAW WORM.

Isosoma hordei Harr.

Exhibit: Adult, work and figure.

THE WHEAT JOINT-WORM.

Isosoma tritici Riley.

Exhibit: Adult, work and figure.

THE HAIRY-FACED JOINT-WORM.

Isosoma hirtifrons How.

Exhibit: Adult and figure.

THE HESSIAN FLY.

Cecidomyia destructor Say.

(Should be known as *Mayetiola.*)

For general article with bibliography see Osborn, Bul. 16, n. s. Div. Ent., U. S. Dept. Agric., 57 pp., 1898; Marlatt, Farmers' Bul. 132, U. S. Dept. Agric., pp. 13–22, 1901.

EXHIBIT: Puparia, adult, work, figures, and map.

THE GREATER WHEAT-STEM MAGGOT.

Meromyza americana Fitch.

For general article see Webster, Bul 42, Div. Ent., U. S. Dept. Agric., pp. 43–51, 1903.

EXHIBIT: Adult, work and figure.

THE AMERICAN FRIT-FLY.

Oscinis soror Macq.

For general article see Webster, Bul. 42, Div. Ent., U. S. Dept. Agric., pp. 57–62, 1903.

EXHIBIT: Adult, work, and figure.

THE LESSER WHEAT-STRAW MAGGOT.

Oscinis carbonaria Loew.

For general article see Webster, Bul. 42, Div. Ent., U. S. Dept. Agric., pp. 51–56, 1903.

EXHIBIT: Adult.

CHLOROPS PROXIMA Say.

For short account see Comstock, Rept. U. S. Comm. Agric., 1879, pp. 257–258, 1880.

EXHIBIT: Adult and work.

INSECTS INJURIOUS TO HOPS.

THE HOP PLANT-LOUSE.

Phorodon humuli Schr.

(Attacks hop and plum.)

For full life history see Riley, Circ. 2, Div. Ent., U. S. Dept. Agric., 1891.

EXHIBIT: Adult, work, and figures, with two enemies: *Chrysopa* sp. and *Adalia bipunctata* Linn.

THE COMMA BUTTERFLY.

Polygonia comma Harr.

(Formerly *Grapta.*)

For general account see Howard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 50–51, 1897.

EXHIBIT: Larva and adult.

THE SEMICOLON BUTTERFLY.

Polygonia interrogationis Fab.

For general account see Howard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 47–49, 1897.

EXHIBIT: Larva and adult.

THE HOP GRUB.

Gortyna immanis Guen.

For general account and life history see Howard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 40–44, 1897.

EXHIBIT: Pupa, adult, and work.

THE HOP SNOUT-MOUTH.

Hypena humuli Harr.

For general account see Howard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 44–47, 1897.

EXHIBIT: Larva, pupa and adult.

THE VARIEGATED CUTWORM.

Peridroma saucia Hübn.

For general bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent,, U. S. Dept. Agric., pp. 46–64, 1901.

EXHIBIT: Larva and adult.

INSECTS INJURIOUS TO CLOVER.

For list of clover insects, and short articles on several important species see Bruner and Hunter, Rpt. St. Bd. Agr. Nebr., pp. 240–285, 1898.

INJURING THE ROOTS.

THE CLOVER ROOT-BORER.

Hylastinus trifolii Müll.

(Formerly *Hylastes.*)

For general articles see Riley, Rpt. U. S. Dept. Agr., f. 1878, pp. 248–250, 1879.

EXHIBIT: Adult, work, figure, and enemy, *Telephorus bilineatus* Say.

INJURING THE STEM.

THE CLOVER STEM-BORER.

Languria mozardi Latr.

For general account see Weed, Bul. Ohio Agr. Expt. Sta., 2d series, v. III, No. 8, p. 235, 1890.

EXHIBIT: Adult.

INJURING THE LEAVES.

THE CLOVER MITE.

Bryobia pratensis Garm.

For general article see Garman, 14th Rpt. St. Ent. Ill., p. 73, 1885; Bruner, Rpt. Nebr. St. Bd. Agric., f., 1898, pp. 280–284, 1899; Marlatt, Circ. 19, Div. Ent., U. S. Dept. Agric., 1897.

Exhibit: Figure.

CLOVER ALEYRODES.

Aleyrodes sp.

Exhibit: Adult and work.

THE WHEAT THRIPS.

Thrips tritici Fitch.

For citations to literature see Lintner, 11th Rpt. N. Y. St. Ent., pp. 247–250, 1896.

Exhibit: Figure.

THE CLOVER-LEAF WEEVIL.

Phytonomus punctatus Fabr.

For general account see Lintner, 1st. Rpt. St. Ent. N. Y., pp. 247–253, 1883; Sanderson, Insects injurious to staple crops, pp. 177–179, 1902.

Exhibit: Larva, cocoon, adult, work, figure, and enemy, *Collops 4-maculatus* Fab.

THE GRAPE-VINE COLASPIS.

Colaspis brunnea Fab.

For general article see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 13–14, 1903.

Exhibit: Adult.

THE 12-SPOTTED CUCUMBER BEETLE.

Diabrotica duodecimpunctata Oliv.

For general account and remedies see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 12–13, 1903; Quaintance, Bul. 26, n. s., Div. Ent., U. S. Dept. Agric., pp. 35–40, 1900.

Exhibit: Adult, figure, and parasite, *Celatoria diabroticæ*.

WESTERN CORN ROOT-WORM.

Diabrotica longicornis Say.

For general account see Forbes, 12th Rpt. St. Ent. Ill., pp. 10–31, figs. 1–5, 1883.

Exhibit: Adult.

THE IMBRICATED SNOUT-BEETLE.

Epicærus imbricatus Say.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 28–29, 1903; Bul. 19, n. s., pp. 62–67, 1899.

Exhibit: Adult.

THE GIBBOUS JUNE-BEETLE.

Lachnosterna gibbosa Burm.

For general account of white grubs see Forbes, 18th Rpt. St. Ent. Ill., pp. 109–144, 1894.

Exhibit: Adult.

THE FLAVESCENT CLOVER-WEEVIL.

Sitones flavescens Marsh.

For brief account see Osborn and Gossard, Bul. 14, Ia. Agric. Expt. Sta., pp. 177–178, 1891.

Exhibit: Adult.

GRAPHORHINUS VADOSUS Say.

For brief account see Webster, Amer. Nat., v. XVI, p. 746, 1882.

Exhibit: Adult.

THE ASH-GRAY BLISTER-BEETLE.

Macrobasis unicolor Kby.

For general account see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 249–250.

Exhibit: Adult.

FOUR-LINED PLANT-BUG.

Pœcilocapsus lineatus Fab.

For general accounts see Lintner, 1st. Rpt. St. Ent. N. Y., pp. 271–281, 1883; Slingerland, Bul. 58, Cornell Univ. Agr. Expt. Sta., pp. 207–239, 1893.

Exhibit: Adult.

THE TARNISHED PLANT-BUG.

Lygus pratensis Linn.

For general account see Riley, Rpt. U. S. Dept. Agric., f. 1884, pp. 312–315, 1885.

Exhibit: Adult.

THE CLOVER-LEAF MIDGE.

Cecidomyia trifolii Loew.

For brief articles see Bruner, Rpt. St. Bd. Agric. Nebr., 1898, pp. 250–251, 1899; Comstock, Rpt. U. S. Dept. Agric., 1879, pp. 197–199, 1880.

Exhibit: Cocoon, adult, and work.

THE RED-BANDED LEAF-ROLLER.

Eulia triferana Walk.

(Formerly *Lophoderus.*)

For brief accounts see Lugger, 4th Rpt. State Ent. Minn., p. 231, 1899; Forbes, 14th Rpt. St. Ent. Ill., pp. 20–21, 1885.

Exhibit: Pupa and adult.

THE RUSTY-BROWN TORTRIX.

Platynota flavedana Clem.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 231–232, 1899.

Exhibit: Eggs, pupa, and adult.

THE SULPHUR-COLORED TORTRIX.

Epagoge sulfureana Clem.

(Formerly *Tortrix* and *Dichelia.*)

For brief account see Lugger, 4th Rpt. S. Ent. Minn., pp. 232–233, 1899. For bibliography see Forbes, 14th Rpt. St. Ent. Ill., pp. 17–20, 1885.

Exhibit: Pupa, adult, and work.

CŒLOSTATHMA DISCOPUNCTANA Clem.

(Formerly *Amphisa.*)

For brief notice see Comstock, Rpt. U. S. Dept. Agric., f. 1880, p. 258, 1881.

Exhibit: Pupa and adult.

THE FALL ARMY WORM.

Laphygma frugiperda S. & A.

For full life history and bibliography see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 13–45, 1901.

Exhibit: Adult.

ANAPHORA POPEANELLA Clem.

For general account see Riley and Howard, Insect Life, v. III, pp. 27–28, 1890.

Exhibit: Adult.

THE OBLIQUE-BANDED LEAF-ROLLER.

Archips rosaceana Harr.

(Formerly *Cacœcia.*)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 226–227, 1899.

Exhibit: Pupa and adult.

THE GARDEN WEB-WORM.

Loxostege similalis Guen.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 39–40, 1903.

Exhibit: Adult and work.

ARISTOTELIA ROSEOSUFFUSELLA Clem.

(Formerly *Gelechia.*)

For brief reference to food plant see Murtfeldt, Bul. 23, Div. Ent., U. S. Dept. Agric., p. 54, 1891.

Exhibit: Pupa and adult.

ECTROPIS CRESPUSCULARIA D. and S.

(Has been placed in genera *Cymatophora*, *Cleora*, and *Boarmia*.)

For brief accounts see Packard, 5th Rpt. U. S. Ent. Comm., p. 371, 1890; Lugger, 4th Rpt. St. Ent. Minn., p. 188, 1899.

Exhibit: Adult.

DRASTERIA ERECHTEA Cram.

For general account see Slingerland, Insect Life, vol. V, pp. 87–88, 1892.

Exhibit: Larva, cocoon, pupa, and adult.

THE CHICKWEED GEOMETER.

Hæmatopsis grataria Fabr.

For brief notice see Forbes, 14th Rpt. St. Ent. Ill., p. 74, 1885.

Exhibit: Adult.

IO MOTH.

Automeris io Fab.

For general account see Lugger, 4th Rpt. State Ent. Minn., pp. 126–129, fig. 130, and pl. 16, fig. 129, 1899.

Exhibit: Larva, cocoon, and adult.

CATOPYRRHA DISSIMILARIA Hübn.

(Formerly *Aspilates*.)

Exhibit: Adult.

THE GREEN CLOVER WORM.

Plathypena scabra Fab.

(Formerly called *Hypena*.)

For accounts see Comstock, Rpt. U. S. Dept. Agric., 1879, p. 252, 1880; Chittenden, Bull. 30, n. s., Div. Ent., U. S. Dept. Agric., p. 44–50, 1901.

Exhibit: Larva, pupa, and adult.

THE SMALL WHITE BRISTLY CUTWORM.

Mamestra renigera Steph.

For short account see Forbes, 16th Rpt. St. Ent. Ill., pp. 95–96, 1890.

Exhibit: Larva, pupa, and adult.

THE CLOVER CUTWORM.

Mamestra trifolii Rott.

For account see Riley, Rpt. U. S. Dept. Agric. f. 1883, pp. 123-124, 1883.

Exhibit: Larva and adult.

ARMY WORM.

Heliophila unipuncta Harv.

(Formerly *Leucania*.)

For bibliography and life history see Lintner, 12th Rpt. N. Y. St. Ent., pp. 190–214, 1896.

Exhibit: Larva, pupa, and adult.

THE VARIEGATED CUTWORM.

Peridroma saucia Hübn.

For general bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 46–64, 1902.

Exhibit: Larva, adult, and figure.

THE COMMELINA OWLET MOTH.

Prodenia commelinæ S. & A.

For life history and general account see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 59–64, Pl. IV, fig. 1, 1901.

Exhibit: Larva, pupa, and adult.

THE DARK-SIDED CUTWORM.

Euxoa messoria Harr.

(Formerly *Carneades.*)

For general account see Riley, Rept. U. S. Dept. Agric. f. 1884, pp. 290–291, 1885.

Exhibit: Larva and adult.

THE SMEARED DAGGER.

Apatela oblinita S. & A.

(Also called *Acronycta.*)

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 567–568, 1890.

Exhibit: Larva, cocoon, and adult.

THE BRONZED CUTWORM.

Nephelodes minians Guen.

For life history and partial bibliography see Lintner, 1st Rpt. St. Ent. N. Y., pp. 99–110, 1882; Riley, Rpt. U. S. Dept. Agric. f. 1890, pp. 244–246, 1891.

Exhibit: Larva and adult.

THE CABBAGE LOOPER.

Autographa brassicæ Riley.

(Formerly *Plusia.*)

For general account and life history see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 60–69, 1902.

Exhibit: Larva, adult, and figure.

THE NAIS TIGER-MOTH.

Apantesis nais Dru.

For account see Beutenmuller, "Cat. Lepid. N. Y." Ann. Acad. N. Y., p. 206, 1890.

Exhibit: Adult.

ZEBRA CATERPILLAR.

Mamestra picta Harr.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 42–43, 1903.

Exhibit: Larva and adult.

THE ISABELLA TIGER-MOTH.

Isia isabella S. & A.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 44–45, 1903.

Exhibit: Larva and adult.

THE NORTHERN CLOUDY-WING.

Thorybes pylades Scud.

(Formerly *Eudamus.*)

Exhibit: Adult.

THE COMYNTAS BUTTERFLY.

Everes comyntas Godt.

(Formerly *Lycæna.*)

For brief account see Lintner, 4th Rpt. N. Y. St. Ent., p. 137, 1888.

Exhibit: Adult.

THE AMERICAN COPPER.

Heodes hypophlœas Bd.

(Formerly *Chrysophanus.*)

Exhibit: Adult.

LEMONIAS EDITHA Bd.

(Formerly *Melitæa.*)

Exhibit: Figure.

SOUTHERN DOG-FACE BUTTERFLY.

Zerene cæsonia Stoll.

(Formerly *Colias.*)

For brief notice see Thomas, 10th Rpt. St. Ent. Ill., p. 78, 1881; Howard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., p. 84, 1897.

Exhibit: Adult.

THE ORANGE SULPHUR.

Eurymus eurytheme Bd.

(Formerly *Colias.*)

For brief account see French, 7th Rpt. St. Ent. Ill., pp. 147–148, 1878.

Exhibit: Larva and adult.

THE YELLOW BUTTERFLY.

Eurymus philodice Godt.

(Formerly *Colias.*)

For brief account see Davis, Bul. 116, Mich. Agr. Expt. Sta., p. 61, 1894.

Exhibit: Adult.

THE CLOUDLESS SULPHUR.

Callidryas eubule Linn.

For brief account see French, 7th Rpt. St. Ent. Ill., pp. 147–148, 1878.

Exhibit: Larva, pupa, and adult.

THE BLACK-BORDERED YELLOW.

Eurema nicippe Cram.

(Formerly called *Terias.*)

For brief account see French, 7th Rpt. St. Ent. Ill., p. 148, 1878.

Exhibit: Larva, pupa, and adult.

THE LITTLE SULPHUR.

Eurema euterpe Men.

(Formerly *Terias lisa.*)

For brief account see French, 7th Rpt. St. Ent. Ill., p. 148, 1878.

Exhibit: Adult.

OLETHREUTES INSTRUTANA Clem.

Exhibit: Adult.

THE CLOVER HAY WORM.

Hypsopygia costalis Fab.

(Formerly called *Asopia* and *Pyralis.*)

For bibliography and general account see Lintner, 11th Rpt. St. Ent. N. Y., pp. 145–151, 1896.

Exhibit: Larva and adult.

THE MEAL SNOUT-MOTH.

Pyralis farinalis Linn.

For short account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., pp. 10–11, 1897.

Exhibit: Larva, pupa, cocoon, and adult.

THE CLOVER PLANT-LOUSE.

Macrosiphum trifolii Perg.

(Attacks dandelion, oats, red clover, strawberry, wheat, &c.)

For general account see Pergande, Bul. 44, Div. Ent., U. S. Dept. Agric., pp. 21–23, 1904.

Exhibit: Figure.

THE TWO-STRIPED LOCUST.

Melanoplus bivittatus Say.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 363–368, pl. 24, fig. 5, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 31–32, 1891.

Exhibit: Adult and figure.

THE LESSER LOCUST.

Melanoplus atlanis Riley.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 178–183, pl. 12, fig. 7, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 26–27, 1891.

Exhibit: Adult.

THE DIFFERENTIAL LOCUST.

Melanoplus differentialis Thos.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 349–354, pl. 23, figs. 3 and 4; Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., pp. 7–26, 1901.

Exhibit: Adult.

RED-LEGGED LOCUST.

Melanoplus femur-rubrum DeG.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 278–285; pl. 1, fig. h; pl. 19, figs. 1–3, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 27–28, 1891.

Exhibit: Adult.

THE ROCKY-MOUNTAIN LOCUST.

Melanoplus spretus Thos.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., vol. XX, pp. 184–190, pl. 12, fig. 8, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 9–26, 1891.

Exhibit: Adult.

INJURING THE FLOWERS AND SEEDS.

THE CLOVER-FLOWER MIDGE.

Cecidomyia leguminicola Lint.

(Should be known as *Dasyneura trifolii* Lint.)

For general account see Riley, Rpt. U. S. Dept. Agric., 1878, pp. 250–252, 1879.

Exhibit: Cocoon, adult, and figure.

THE CLOVER-SEED CHALCIS-FLY.

Bruchophagus funebris How.

For brief accounts see Hopkins, Bul. 6, n. s., Div. Ent., U. S. Dept. Agric., p. 73, 1896, and Bul. 17, n. s., p. 45, 1898; Titus, Bul. 44, Div. Ent., U. S. Dept. Agric., pp. 77–80, 1904.

Exhibit: Adult and work.

THE CLOVER-SEED WORM.

Enarmonia interstinctana Clem.

(Formerly called *Grapholitha.*)

For bibliography and general account see Lintner, 11th Rpt. St. Ent. N. Y., pp. 152–157, 1896.

Exhibit: Pupa, adult, and work.

INSECTS INJURIOUS TO SUGAR BEET.

For general articles see Forbes and Hart, Bul. 60, Ill. Agr. Expt. Sta., 136 pp., 1900; Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., 71 pp., 1903.

RED-LEGGED LOCUST.

Melanoplus femur-rubrum DeG.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 278–285, pl. 1, fig. h, pl. 19, figs. 1–4, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 27–28, 1891.

Exhibit: Adult and figure.

THE DIFFERENTIAL LOCUST.

Melanoplus differentialis Thos.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 349–354, pl. 23, figs. 3 and 4, 1897; also Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., pp. 7–26, 1901.

Exhibit: Adult and figure.

THE ROCKY-MOUNTAIN LOCUST.

Melanoplus spretus Thos.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 184–190, pl. 12, fig. 8, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 9–26, 1891.

Exhibit: Adult.

THE TWO STRIPED LOCUST.

Melanoplus bivittatus Say.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 363–368, pl. 24, fig. 5, 1897.

Exhibit: Adult, nymph, and figure.

THE LESSER LOCUST.

Melanoplus atlanis Riley.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 178–183, pl. 12, fig. 7, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 26–27, 1891.

Exhibit: Adult.

THE CAROLINA LOCUST.

Dissosteira carolina Linn.

For short account see Forbes and Hart, Bul. 60, Ill. Agr. Expt. Sta., pp. 479–480, 1900.

Exhibit: Nymph, adult, and parasite *Frontina frenchii* Will.

THE BEET LEAF-MINER.

Pegomya vicina Lint.

Exhibit: Adult and figure.

THE BEET CHLOROPS.

Chlorops assimilis Macq.

Exhibit: Puparium and adult.

THE COMMON ARMY WORM.

Heliophila unipuncta Harr.

(Formerly *Leucania*.)

For bibliography and life history see Lintner, 12th Rept. St. Ent. N. Y., pp. 190–214, 1896.

Exhibit: Larva and adult.

THE VARIEGATED CUTWORM.

Peridroma saucia Hübn.

For general bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 46–64, 1902.

Exhibit: Larva, adult, and figure.

THE PURSLANE CATERPILLAR.

Copidryas gloveri G. & R.

Exhibit: Larva and adult.

FALL ARMY WORM.

Laphygma frugiperda S. & A.

For full bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 40–45, 1901.

Exhibit: Larva, adult, and figure.

THE WHITE-LINED SPHINX.

Deilephila lineata Fabr.

Exhibit: Adult and figure.

THE BEET ARMY WORM.

Caradrina exigua Hübn.

For general articles see Gillette, 12th Rpt. Colo. Agr. Expt. Sta., p. 39, 1900; Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 37–46, 1902.

Exhibit: Adult and figure.

THE ZEBRA CATERPILLAR.

Mamestra picta Harr.

For bibliography and general life history see Felt, 14th Rpt. N. Y. St. Ent., pp. 201–207, 1898.

Exhibit: Larva and adult.

GARDEN WEB-WORM.

Loxostege similalis Guen.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 39–40, 1903.

Exhibit: Cocoon, adult, and figure.

THE SUGAR-BEET WEBWORM.

Loxostege sticticalis Linn.

For general account see Forbes, Bul. 60, Ill. Agr. Expt. Sta., p. 457–459, 1900.

EXHIBIT: Cocoon, pupa, adult, and figure.

THE ISABELLA TIGER MOTH.

Isia isabella S. & A.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 44–45, 1903.

EXHIBIT: Larva, adult, and figure.

THE CLOVER CUTWORM.

Mamestra tripolii Rott.

For account see Riley, Rept. U. S. Dept. Agric., 1883, pp. 123–124, 1883.

EXHIBIT: Larva, adult, and parasites *Ophion purgatum* Say. and *Euphorocera claripennis* Macq.

THE CABBAGE LOOPER.

Autographa brassicæ Riley.

For general account and life history see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 60–69, 1902.

EXHIBIT: Larva, adult, and parasite *Limneria tibiator* Cr

THE GARDEN FLEA-HOPPER.

Halticus uhleri Giard.

For general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 57–62, 1899.

EXHIBIT: Adult and figure.

THE TARNISHED PLANT-BUG.

Lygus pratensis Linn.

For general account see Riley, Rept. U. S. Dept. Agric. f. 1884, pp. 312–315, 1885.

EXHIBIT: Adult and figure.

THE SANDY GROUND BUG

Emblethis arenarius Linn.

EXHIBIT: Adult.

PURSLANE BUG.

Geocoris bullatus Say.

EXHIBIT: Adult.

THE MILITARY BUG.

Hadronema militaris Uhl.

EXHIBIT: Adult.

CLOUDED PIGWEED BUG.

Sphragisticus nebulosus Fall.

EXHIBIT: Adult.

THE BROWN LEAF-HOPPER.

Agallia sanguinolenta Prov.

Exhibit: Adult.

THE CHINCH-BUG.

Blissus leucopterus Say.

For general article and life history see Webster, Bul. 15, n. s., Div. Ent., U. S. Dept. Agric., 82 pp. 1898.

Exhibit: Eggs, nymph, adult, and figure.

THE FALSE CHINCH-BUG.

Nysius angustatus Uhl.

(Attacks many garden crops.)

Exhibt: Adult and figure.

HOODED PLANT-BUG.

Euthoctha galeator Fab.

Exhibit: Eggs, nymph, and adult.

THE IMBRICATED SNOUT-BEETLE.

Epicaerus imbricatus Say.

For detailed account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 62–67, 1899.

Exhibit: Adult and figure.

THE GIBBOUS JUNE BEETLE.

Lachnosterna gibbosa Burm.

For general account of white grub see Forbes, 18th Rept. St. Ent. Ill., pp. 109–144, 1894.

Exhibit: Adult and figure.

THE 12-SPOTTED CUCUMBER BEETLE.

Diabrotica duodecempunctata Ol.

For general account and remedies see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 12–13, 1903; Quaintance, Bul. 26, n. s., pp. 35–40, 1900.

Exhibit: Adult, figures, and parasite *Celatoria diabroticæ*.

MONOCREPIDIUS VESPERTINUS Fab.

Exhibit: Adult and figure.

PENCILED SNOUT-BEETLE.

Centrinus penicellus Hbst.

Exhibit: Adult.

THE GREATER SUGAR-BEET LEAF-BEETLE.

Monoxia puncticollis Say.

Exhibit: Adult and figure.

THE LESSER SUGAR-BEET LEAF-BEETLE.

Monoxia consputa Lec.

Exhibit: Adult and figure.

THE GRAPE-VINE COLASPIS.

Colaspis brunnea Fab.

For general article see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 13–14, 1903.

Exhibit: Adult and figure.

WHITE GRUB; MAY BEETLE.

Lachnosterna fusca Fröh.

For account of white grubs injuring corn see Forbes, 18th Rept. St. Ent. Ill., pp. 109–145, 1894.

Exhibit: Adult and figure.

THE CONVEX FLEA-BEETLE.

Psylliodes convexior Lec.

Exhibit: Adult.

THE PALE-STRIPED FLEA-BEETLE.

Systena blanda Mels.

For general articles see Chittenden, Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 22–29, 1900; Bul. 43, Div. Ent., p. 16, 1903.

Exhibit: Adult and figure.

THE SPINACH FLEA-BEETLE.

Disonycha xanthomelæna Dalm.

Exhibit: Adult, figure, and parasite *Hypostena barbata* Coq.

THE WAVY-NECKED FLEA-BEETLE.

Disonycha crenicollis Say.

Exhibit: Adult.

THE TRIANGULAR FLEA-BEETLE.

Disonycha triangularis Say.

Exhibit: Adult.

THE CUCUMBER FLEA-BEETLE.

Epitrix cucumeris Harr.

For short account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 89–90, 1899.

Exhibit: Adult and figure.

THE TOOTHED FLEA-BEETLE.

Chætocnema denticulata Illig.

Exhibit: Adult.

THE ASH-GRAY BLISTER-BEETLE.

Macrobasis unicolor Kby.

For short article see Chittenden, Yearbook, U. S. Dept. Agric., f. 1898, pp. 249–250, 1899.

Exhibit: Adult.

THE SPOTTED BLISTER-BEETLE.

Epicauta maculata Say.

For general account see Saunders, Bul. 57, S. Dak. Agric. Expt. Sta., p. 52, 1898; Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 24–25, 1903.

Exhibit: Adult and figure.

THE MARGINED BLISTER-BEETLE.

Epicauta cinerea Först.

For brief account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 25, 1903.

Exhibit: Adult and figure.

BLACK BLISTER-BEETLE.

Epicauta pennsylvanica DeG.

For brief account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 25, 1903.

Exhibit: Adult and figure.

THE STRIPED BLISTER-BEETLE.

Epicauta vittata Fabr.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Agric., pp. 22–23, 1903.

Exhibit: Adult and figure.

NUTTALL'S BLISTER-BEETLE.

Cantharis nuttalli Say.

For short article see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 27, 1903.

Exhibit: Adult and figure.

INSECTS INJURIOUS TO TOBACCO.

For general articles see Howard, Farmers' Bul. 120, U. S. Dept. Agric., 1900; Yearbook, 1898, pp. 120–150.

NORTHERN TOBACCO WORM; TOMATO WORM.

Phlegethontius quinquemaculata Haw.

(Formerly *Protoparce celeus.*)

For general account see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 10–14, 1900.

Exhibit: Larva, pupa, adult, and figure.

SOUTHERN TOBACCO WORM; HORNBLOWER.

Phlegethontius sexta Joh.

(Formerly *Protoparce carolina.*)

For general account see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 10–14, 1900; Alwood, Bul. 17, n. s., Div. Ent., U. S. Dept. Agric., pp. 72–74, 1898.

Exhibit: Larva, pupa, adult, and figure.

TOBACCO BUDWORM.

Chloridea virescens Fab.

(Formerly *Heliothis rhexiæ* S. & A.)

For general account see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 14–16, 1900.

Exhibit: Pupa, adult, and figure.

THE VARIEGATED CUTWORM.

Peridroma saucia Hübn.

For general bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 46–64, 1901.

Exhibit: Adult and figure.

THE BLACK CUTWORM.

Agrotis ypsilon Rott.

For general account see Riley, Rpt. U. S. Dept. Agric. f. 1884, pp. 294–295, 1885.

Exhibit: Adult and figure.

CORN-EAR WORM; COTTON BOLLWORM.

Heliothis obscura Fab.

(Feeds also on tobacco and tomato. For special case illustrating life history see under cotton and corn exhibits.)

For life history and general account see Quaintance, Farmers' Bul., 191, U. S. Dept. Agric., 1904.

Exhibit: Larva, pupa, adult, and figure.

GRANULATED CUTWORM.

Feltia annexa Tr.

For general account see Riley, Rpt. U. S. Dept. Agric. 1884, pp. 291–292, 1885. For description of stages see French Canad. Ent., v. XIV, pp. 207–210, 1882.

Exhibit: Adult and figure.

THE PRETTY CUTWORM.

Mamestra legitima Grt.

For brief account see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 24–25, fig. 20, 1900.

Exhibit: Larva, pupa, adult, and figure.

THE COMMELINA OWLET MOTH.

Prodenia commelinæ S. & A.

For life history and general account see Chittenden, Bul. 27, n. s., Div. Ent. U. S. Dept. Agric., pp. 59–64, pl. iv, fig. 1, 1901.

Exhibit: Larva, adult, and figure.

THE CABBAGE LOOPER.

Autographa brassicæ Riley.

For general account and life history see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 60–69, 1902.

Exhibit: Adult and figure.

ŒCANTHUS QUADRIMACULATUS Beut.

For brief notice as *Œ. fasciatus* see Howard, Farmers' Bul. 120, U. S. Dept. Agric., p. 25, 1900.

Exhibit: Adult.

TOBACCO SUCKFLY.

Dicyphus minimus Uhl.

For general account see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 16–18, 1900.

Exhibit: Adult and figure.

TOBACCO SPLITWORM; POTATO-TUBER WORM.

Phthorimæa operculella Zell.

(Works in leaves and stems. Formerly called *Gelechia solanella.*)

For general accounts see Riley and Howard, Insect Life, v. IV, pp. 239–242, 1892; Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 19–22, 1900.

Exhibit: Adult and figure.

THE TOBACCO FLEA-BEETLE.

Epitrix parvula Fab.

For general account and life history see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 85–87, 1899; Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 5–10, 1900.

Exhibit: Adult and figure.

THE TOBACCO STALK WEEVIL.

Trichobaris mucorea Lec.

For general account see Chittenden, Bul. 38, Div. Ent., U. S. Dept. Agric., pp. 66–70, 1902.

Exhibit: Cocoon, adult, and work.

EUSCHISTUS VARIOLARIUS Beauv.

For brief accounts see Garman, Bul. 66, Ky. Agr. Exp. Sta., pp. 33–34, 1897; Howard, Farmer's Bul. 120, U. S. Dept. Agric., pp. 18–19, 1900.

Exhibit: Adult.

THE TOBACCO THRIPS.

Thrips tabaci Lind.

For brief account see Howard, Farmer's Bul. 120, U. S. Dept. Agric., pp. 24–25, 1900.

Exhibit: Figure.

THE CIGARETTE BEETLE.

Lasioderma testaceum Dufts.

(Formerly *L. serricorne.*)

For general account see Chittenden, Bul. 4, n. s., revis. ed., Div. Ent., U. S. Dept. Agric., pp. 126–127, 1897.

Exhibit: Adult, work, and figure.

THE DRUG-STORE BEETLE.

Sitodrepa panicea Linn.

For general account see Chittenden. Bul. 4, n. s., revis. ed., Div. Ent., U. S. Dept. Agric., pp. 124–126, 1897.

Exhibit: Adult and figure.

INSECTS INJURIOUS TO BEANS AND PEAS.

THE LIMA-BEAN STEM-BORER.

Monoptilota nubilella Hulst.

(Bores in stalks of Lima beans.)

For life history and general account see Chittenden. Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 9–17, 1900.

Exhibit: Larva, cocoon, adult, work, and figure.

SMALLER CORN STALK-BORER.

Elasmopalpus lignosellus Zell.

For life history and general account see Chittenden. Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 17–22, 1900.

Exhibit: Larva, adult, and figure.

NUTTALL'S BLISTER BEETLE.

Cantharis nuttalli Say.

For short article see Chittenden. Bul. 43. Div. Ent., U. S. Dept. Agric., p. 27, 1903.

Exhibit: Adult and figure.

THE ASH-GRAY BLISTER BEETLE.

Macrobasis unicolor Kby.

For short article see Chittenden. Yearbook. U. S. Dept. Agric., f. 1898, pp. 249–250, 1899.

Exhibit: Adult.

THE BEAN LEAF-BEETLE.

Cerotoma trifurcata Först.

(Formerly *C. caminea* Fab.)

For general account see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 253–254.

Exhibit: Adult and figure.

THE BEAN LADYBIRD.

Epilachna corrupta Muls.

For general account see Gillette, Bul. 47, Colorado Agr. Expt. Sta., pp. 41–43, 1898; Chittenden, Yearbook, U. S. Dept. Agric., f. 1898, pp. 251–253, 1899.

EXHIBIT: Adult and figure.

THE 12-SPOTTED CUCUMBER BEETLE.

Diabrotica duodecempunctata Ol.

For general accounts and remedies see Quaintance, Bul. 26, n. s., Div. Ent., U. S. Dept. Agric., pp. 35–40, 1900; Chittenden, Bul. 43, pp. 12–13, 1903.

EXHIBIT: Adult.

THE IMBRICATED SNOUT-BEETLE.

Epicaerus imbricatus Say.

For detailed account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 62–67, 1899; for general account, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 28–29, 1903.

EXHIBIT: Adult.

THE BANDED FLEA-BEETLE.

Systena tæniata Say.

For short account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 17, 1903.

EXHIBIT: Adult.

THE PALE-STRIPED FLEA-BEETLE.

Systena blanda Melsh.

For general article see Chittenden, Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 22–29, 1900; Bul. 43, p. 16, 1903.

EXHIBIT: Adult and figure.

THE LEAF-MINING LOCUST BEETLE.

Odontota dorsalis Thunb.

(Lives on locust, but attacks beans and other leguminous plants.)

For full life history, bibliography, and distribution see Chittenden, Bul. 38, Div. Ent., U. S. Dept. Agric., pp. 70-73, 1902.

EXHIBIT: Adult and figure.

THE DISTENDED MAY BEETLE.

Lachnosterna farcta Lec.

For short notices see Comstock, Rpt. U. S. Dept. Agric., 1879, pp. 247–248, Pl. V, fig. 5, 1880; Howard, Bul. 22, n. s., Div. Ent., U. S. Dept. Agric., p. 107, 1900.

EXHIBIT: Adult.

THE GARDEN FLEA-HOPPER.

Halticus uhleri Giard.

For general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 57-62, 1899.

Exhibit: Adult and figure.

THE DINGY CUTWORM.

Feltia subgothica Haw.

For brief account see Chittenden, Yearbook, U. S. Dept. Agric., f. 1898, p. 257, 1899.

Exhibit: Adult.

SALT-MARSH CATERPILLAR.

Estigmene acræa Dru.

(Formerly called *Leucarctia.*)

For short account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 43–44, fig 41, 1903.

Exhibit: Adult.

YELLOW-BEAR CATERPILLAR.

Diacrisia virginica Fab.

(Formerly called *Spilosoma.*)

For general account see Lugger, 4th Rpt. State Ent. Minn., pp. 79–81, fig. 78, 1899.

Exhibit: Adult and figure.

THE BEAN CUTWORM.

Ogdoconta cinereola Guen.

(Feeds on buds and leaves.)

For life history and general account see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 98–100, 1902.

Exhibit: Adult and figure.

THE ROLLER WORM.

Eudamus proteus Linn.

(Feeds on buds and leaves.)

For general article and life history see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 92–96, 1902.

Exhibit: Larva, chrysalis, adult, and figure.

COMMON BEAN WEEVIL.

Bruchus obtectus Say.

For general account and life history see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 239–242.

Exhibit: Adult, work, and figure.

THE PEA WEEVIL.

Bruchus pisorum Linn.

For general account and life history see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 234–239.

Exhibit: Adult, work, and figure.

THE COWPEA WEEVIL.

Bruchus chinensis Linn.

For general account and life history see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 242–245.

Exhibit: Adult and figure.

FOUR-SPOTTED BEAN-WEEVIL.

Bruchus quadrimaculatus Boh.

For general account and life history see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 245–247.

Exhibit: Adult and figure.

THE LENTIL WEEVIL.

Bruchus lentis Boh.

For brief account see Chittenden, Yearbook, U. S. Dept. Agric., 1898, p. 248.

Exhibit: Adult.

EUROPEAN BEAN-WEEVIL.

Bruchus rufimanus Boh.

For general account see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 247–248.

Exhibit: Adult.

THE MEXICAN BEAN-WEEVIL.

Spermophagus pectoralis Shp.

For brief account see Chittenden, Yearbook, U. S. Dept. Agric., 1898, p. 248.

Exhibit: Adult and figure.

THE GRAY HAIR-STREAK.

Uranotes melinus Hübn.

(Works in pods of peas and beans, and in silk corn. Formerly *Thecla.*)

For brief article see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 101–102, 1902.

Exhibit: Larva, pupa, adult, and figure.

BOLLWORM; CORN-EAR WORM.

Heliothis obscura Fab.

(See special case for full life history with illustrations.)

For life history and general account see Quaintance, Farmers' Bul. 191, U. S. Dept. Agric., 1904.

Exhibit: Larva, adult, work, and figure.

THE IMPORTED PEA-MOTH.

Semasia nigricana Steph.

For general accounts and life history see Fletcher, Rpt. Ent. and Bot., Can. Dept. Agric., 1900, p. 214, 1901; Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 96–98, 1902.

Exhibit: Adult and figure.

INSECTS INJURIOUS TO CRUCIFERS.

IMPORTED CABBAGE-WORM.

Pontia rapæ Sch.

(Formerly *Pieris.*)

For general articles see Riley, Rpt. U. S. Dept. Agric., f., 1883, pp. 108-113, 1884; Lugger, 1st Rpt. St. Ent. Minn., pp. 71–77, Pl. VI, 1896.

Exhibit: Larva, chrysalis, and adult.

THE LARGE CABBAGE BUTTERFLY.

Pontia monuste Linn.

For general article see Riley, Rpt. U. S. Dept. Agric., 1883, pp. 117–118, 1884.

Exhibit: Adult.

THE POT-HERB BUTTERFLY.

Pontia oleracea Boisd.

(Formerly *Pieris.*)

For general account see Riley, Rpt. U. S. Dept. Agric., 1883, pp. 115–117, 1884.

Exhibit: Chrysalis and adult.

THE SOUTHERN CABBAGE WORM.

Pontia protodice Boisd.

For general articles see Riley, Rpt. U. S. Dept. Agric., f., 1883, pp. 114-115, 1884; Lugger, 1st Rpt. St. Ent. Minn., pp. 71–77, Pl. VII, 1896.

Exhibit: Chrysalis and adult.

GARDEN WEB-WORM.

Loxostege similalis Guen.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 39–40, 1903.

Exhibit: Adult and figure.

GRANULATED CUTWORM.

Feltia annexa Tr.

For description of eggs and larval stage see French, Can. Ent., v. XIV, pp. 207-210, 1882. For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 291–292, 1885.

Exhibit: Larva, pupa, adult, and figure.

THE STRIPED CUTWORM.

Feltia subgothica Haw.

For general account see Slingerland, Bul. 104, Cornell Univ. Agric. Expt. Sta., pp. 274–279, 1895.

Exhibit: Larva, adult, and figure.

SHAGREENED CUTWORM.

Feltia malefida Guen.

(Larvæ destroy young plants.)

For short account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 292–293, 1885.

Exhibit: Adult and figure.

THE VARIEGATED CUTWORM.

Peridroma saucia Hübn.

For general bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 46–64, 1902.

Exhibit: Larva, adult, and figure.

THE BLACK CUTWORM.

Agrotis ypsilon Rott.

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 294–295, 1885.

Exhibit: Larva, adult, and figure.

THE SPECKLED CUTWORM.

Mamestra subjuncta G. & R.

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, p. 296, 1885.

Exhibit: Larva, pupa, and adult.

THE GLASSY CUTWORM.

Hadena devastatrix Brace.

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 296–297, 1885.

Exhibit: Adult.

THE W-MARKED CUTWORM.

Noctua clandestina Harr.

For general account see Slingerland, Bul. 104, Cornell Univ. Agr. Expt. Sta., pp. 571–574, 1895.

Exhibit: Larva and adult.

FALL ARMY WORM.

Laphygma frugiperda S. & A.

For full bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 40–45, 1901.

Exhibit: Larva, adult, and figure.

THE CROSS-STRIPED CABBAGE WORM.

Evergestis rimosalis Guen.

(Formerly *Pionea.*)

For general article see Chittenden, Bul. 33 n. s., Div. Ent., U. S. Dept. Agric., pp. 54–59, 1902.

Exhibit: Larva, pupa, cocoon, adult, and figure.

THE SALT-MARSH CATERPILLAR.

Estigmene acræa Dru.

(Formerly called *Leucarctia.*)

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 43–44, 1903.

Exhibit: Larva, cocoon, and adult.

THE CABBAGE LOOPER.

Autographa brassicæ Riley.

For general account and life history see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 60–69, 1902.

Exhibit: Larva, cocoon, pupa, and adult.

THE DIAMOND-BACK MOTH.

Plutella maculipennis Curtis.

(Formerly *P. cruciferarum.*)

For general account see Lugger, 1st. Rpt. St. Ent. Minn., p. 79, Pl. VI, 1896.

Exhibit: Larva, cocoon, adult, and work.

HARLEQUIN CABBAGE-BUG.

Murgantia histrionica Hahn.

(Feeds on cruciferous plants of all kinds.)

For general accounts see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 309–312, 1885; Smith, Bul. 121, N. J. Agr. Expt. Sta., pp. 3–6, 1897.

Exhibit: Eggs, nymph, and adult.

THE TARNISHED PLANT-BUG.

Lygus pratensis Linn.

For general account see Riley, Rpt. U. S. Dept. Agric., f. 1884, pp. 312–315, 1885.

Exhibit: Adult.

THE EGGPLANT FLEA-BEETLE.

Epitrix fuscula Cr.

For general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 87–89, 1899.

Exhibit: Adult and figure.

THE RED TURNIP BEETLE.

Entomoscelis adonidis Pallas.

For partial life history, short accounts, and bibliography see Fletcher, Rpt. Ent. and Bot.; Can. Dept. Agr., 1892, pp. 152–155, 1893; loc. cit., 1900, pp. 241, 1901; Chittenden, Bull. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 49–53, 1902.

Exhibit: Figure.

WESTERN CABBAGE FLEA-BEETLE.

Phyllotreta albionica Lec.

Exhibit: Adult.

HORSE-RADISH FLEA-BEETLE.

Phyllotreta armoraciæ Koch.

For general accounts see Chittenden, Ins. Life, v. VII, pp. 404–406, 1895; Bul. 9, n. s., Div. Ent., U. S. Dept. Agric., pp. 21–22, 1897.

Exhibit: Adult.

THE WESTERN FLEA-BEETLE.

Phyllotreta pusilla Horn.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 18–19, 1903.

Exhibit: Adult and figure.

THE STRIPED FLEA-BEETLE.

Phyllotreta vittata Fab.

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 301–304, 1885.

Exhibit: Adult.

WAVY-STRIPED FLEA-BEETLE.

Phyllotreta sinuata Steph.

(Formerly *P. zimmermani.*)

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 304–308, 1885.

Exhibit: Adult.

THE CAULIFLOWER PYRALID.

Pachyzancla bipunctalis Fab.

(Formerly *Botis repetitalis.*)

For description and brief accounts see Comstock, Rpt. U. S. Dept. Agric., 1880, p. 270, 1881; Riley, Rpt. U. S. Dept. Agric., 1883, pp. 128–129, 1884.

Exhibit: Pupa and adult.

THE ZEBRA CATERPILLAR.

Mamestra picta Harr.

For bibliography and general life-history see Felt, 14th Rpt. N. Y. St. Ent., pp. 201–207, 1898.

Exhibit: Larva, pupa and adult.

THE CABBAGE MAGGOT.

Pegomya brassicæ Bouché.

(Formerly *Anthomyia.*)

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 319–321, 1885.

Exhibit: Adult.

THE CABBAGE PLANT-LOUSE.

Aphis brassicæ Linn.

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 317–319, 1885.

Exhibit: Adult and work.

IMPORTED CABBAGE WEBWORM.

Hellula undalis Fab.

For general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 51–57, 1899.

Exhibit: Larva, pupa, adult and figure.

THE CABBAGE CURCULIO.

Ceutorhynchus rapæ Gyll.

For general account and partial life history see Chittenden, Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 39–50, 1900.

Exhibit: Adult and figure.

THE IMPORTED CABBAGE LEAF-MINER.

Scaptomyza graminum Fall.

(Formerly called *Oscinis brassicæ.*)

See Riley, Rpt. U. S. Dept. Agric., 1884, p. 322, 1885. For short account see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 76–77, 1902.

Exhibit: Adult.

INSECTS INJURIOUS TO POTATO.

THE RINGED MILLIPEDE.

Cambala annulata Say.

Exhibit: Figure.

THE SHORT-WINGED MOLE-CRICKET.

Scapteriscus abbreviatus Scudd.

For general account see Chittenden, Bul. 40, Div. Ent., U. S. Dept. Agric., pp. 117–118, 1903. For account of an allied species *S. didactylus* Latr., see Barrett, Bul. 2, Porto Rico Agric. Expt. Sta., 1902.

Exhibit: Adult.

POTATO-TUBER WORM; TOBACCO SPLIT-WORM.

Phthorimæa operculella Zell.

(Formerly *Lita* and *Gelechia solanella.* Works in stems and tubers.)

For general account see Riley and Howard, Insect Life, v. IV, pp. 239–242, 1892; Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 19–22, 1900.

Exhibit: Adult and figure.

THE POTATO-STALK WEEVIL.

Trichobaris trinotata Say.

For life history and general account see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 9–19, 1902.

Exhibit: Adult and work.

STALK-BORER.

Papaipema nitela Guen.

(Formerly *Gortyna* and *Hydræcia.* Bores in stems of various plants.)

For general account see Bird, Can. Ent., v. XXX, pp. 127–128, 1898.

Exhibit: Adult.

THE LITTLE GREEN TORTOISE-BEETLE.

Cassida pallidula Boh.

(Formerly *C. texana.*)

For short account see Riley, Amer. Nat., v. 17, p. 1070, October [17 Sept.], 1883.

Exhibit: Adult.

THE GOLDEN TORTOISE-BEETLE.

Coptocycla bicolor Fab.

(Formerly *C. aurichalcea.*)

For general account see Sanderson, Bul. 59, Md. Agr. Expt. Sta., pp. 139–140, 1899.

Exhibit: Adult.

COLORADO POTATO-BEETLE.

Leptinotarsa decemlineata Say.

(Formerly *Doryphora.*)

For general account of life history see Smith, Rpt. N. J. Agric. Expt. Sta., 1895, pp. 452–458, 1896.

Exhibit: Egg, larva, pupa, adult, figure, and the following enemies: *Brachinus kansanus* Lec., *Chilocorus bivulnerus* Mels., *Coccinella sanguinea* Linn., *Coccinella novemnotata* Hbst., *Harpalus caliginosus* Fab., *Hippodamia convergens* Gúer., *Hippodamia glacialis* Fab., *Lebia atriventris* Say, *Lebia grandis* Htz., *Megilla maculata* DeG., *Nezara hilaris* Say, *Pasimachus elongatus* Lec., *Podisus spinosus* Dall., *Polistes pallipes* Lep., and *Tetracha virginica* Linn.

BOGUS POTATO-BEETLE.

Leptinotarsa juncta Germ.

(This species exhibited merely on account of similarity to preceding species. It feeds on wild Solanums.)

Exhibit: Adult.

THREE-LINED POTATO-BEETLE.

Lema trilineata Oliv

For general account see Riley, 1st. Rpt. St. Ent. Mo., pp. 99–100, 1869.

Exhibit: Adult and figure.

THE WHITE BLISTER-BEETLE.

Macrobasis albida Say.

For brief account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 26, 1903.

Exhibit: Adult.

THE ASH-GRAY BLISTER-BEETLE.

Macrobasis unicolor Kby.

For general account see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 249–250.

Exhibit: Adult.

THE STRIPED BLISTER-BEETLE.

Epicauta vittata Fab.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 22–23, 1903.

Exhibit: Adult.

BLACK BLISTER-BEETLE.

Epicauta pennsylvanica DeG.

For brief account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 25, 1903.

Exhibit: Adult.

THE CROW BLISTER-BEETLE.

Epicauta corvina Lec.

For brief notice see Comstock, Rpt. U. S. Comm. Agric., 1879, p. 251, 1880.

Exhibit: Adult.

THE MARGINED BLISTER-BEETLE.

Epicauta cinerea Först.

For brief account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 24, 1903.

Exhibit: Adult.

THE SPOTTED BLISTER-BEETLE.

Epicauta maculata Say.

For general accounts see Saunders, Bul. 57, S. Dak. Agric. Expt. Sta., p. 52, 1898; Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 24–25, 1903.

Exhibit: Adult and figure.

THE EGG-PLANT FLEA-BEETLE.

Epitrix fuscula Cr.

For general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 87–89, 1899.

Exhibit: Adult.

INSECTS INJURIOUS TO SWEET POTATOES.

For general bulletin see Sanderson, Sweet Potato Insects, Bul. 59, Md. Agric. Expt. Sta., 1900.

SWEET-POTATO ROOT-BORER.

Cylas formicarius Fab.

Exhibit: Adult and work.

SWEET-POTATO HAWK-MOTH.

Phlegethontius cingulata Fab.

Exhibit: Adult.

THE SWEET-POTATO PLUME-MOTH.

Pterophorus monodactylus Linn.

Exhibit: Adult.

LARGER SWEET-POTATO SAWFLY.

Schizocerus privatus Nort.

For general account see Marlatt, Insect Life, v. V, pp. 24–27, fig. 6, 1892.

Exhibit: Adult and figure.

SWEET-POTATO FLEA-BEETLE.

Chætocnema confinis Cr.

Exhibit: Adult.

THE CUCUMBER FLEA-BEETLE.

Epitrix cucumeris Harr.

For short account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 89–90, 1899.

Exhibit: Adult.

THE MOTTLED TORTOISE BEETLE.

Coptocycla signifera Hbst.

(Formerly called *C. guttata.*)

Exhibit: Adult.

BLACK-LEGGED TORTOISE BEETLE.

Cassida nigripes Oliv.

Exhibit: Adult and work.

TWO-STRIPED TORTOISE BEETLE.

Cassida bivittata Say.

Exhibit: Adult.

THE GREEN TORTOISE BEETLE.

Physonota unipunctata Say.

For brief notices see Hamilton, Canad. Ent., v. XVI, pp. 134–135, 1884, and Caulfield, l. c., p. 227.

Exhibit: Adult.

THE ARGUS TORTOISE BEETLE.

Chelymorpha argus Licht.

(Also called *C. cassidea.*)

Exhibit: Adult.

INSECTS INJURIOUS TO TOMATO.

NORTHERN TOBACCO WORM; TOMATO WORM.

Phlegethontius quinquemaculata Haw.

(Formerly *Protoparce celeus.*)

For general account see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 10–14, 1900.

Exhibit: Larva and adult.

SOUTHERN TOBACCO WORM; HORNBLOWER.

Phlegethontius sexta Joh.

(Formerly *Protoparce carolina.*)

For general accounts see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 10–14, 1900; Alwood, Bul. 17, n. s., Div. Ent., U. S. Dept. Agric., pp. 72–74, 1898.

Exhibit: Larva and adult.

THE STALK BORER.

Papaipema nitela Guen.

For general accounts see Bird, Can. Ent., v. XXX, pp. 127–128, 1898; Lugger, 4th Rpt. State Ent. Minn., pp. 167–168, 1899.

Exhibit: Pupa and adult.

THE COMMELINA OWLET MOTH.

Prodenia commelinæ S. & A.

For life history and general account see Chittenden, Bull. 27, n. s., Div. Ent. U. S. Dept. Agric., pp. 59–64, Pl. IV, fig. 1, 1901.

Exhibit: Larva and adult.

CORN-EAR WORM; COTTON BOLLWORM.

Heliothis obscura Fab.

(Feeds also on tobacco and tomato; see under cotton and corn exhibits.)

For life history and general account see Quaintance, Farmers' Bul. 191, 1904.

Exhibit: Larva and adult.

INSECTS INJURIOUS TO ASPARAGUS.

For general article on asparagus insects see Chittenden, Bul. 10, n. s., pp. 54–62, 1898.

THE ASPARAGUS MINER.

Agromyza simplex Loew.

For general account see Sirrine, Bul. 189, N. Y. Agric. Exp. Stat., pp. 277–282, 1900.

Exhibit: Adult.

LOPIDEA MEDIA Say.

Exhibit: Adult.

THE LESSER LOCUST.

Melanoplus atlanis Riley.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 178–183; pl. 12, fig. 7, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 26–27, 1891.

Exhibit: Adult.

THE TWO-STRIPED LOCUST.

Melanoplus bivittatus Say.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 363–368, pl. 24, fig. 5, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 31–32, 1891.

Exhibit: Adult and figure.

RED-LEGGED LOCUST.

Melanoplus femur-rubrum DeG.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 278–285, pl. 1, fig. h; pl. 19, figs. 1–4, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 27–28, 1891.

Exhibit: Adult.

MELANOPLUS PROPINQUUS Scudd.

For original description, see Scudder, Proc. U. S. N. M., v. XX; pp. 285–286, pl. 18, fig. 9, 1897.

Exhibit: Adult.

TWELVE-SPOTTED ASPARAGUS-BEETLE.

Crioceris duodecempunctata Linn.

For detailed account, see Chittenden, Yearbook, U. S. Dept. Agric., 1896, pp. 349–352, 1897.

Exhibit: Adult, figure, and adult of enemy, *Podisus spinosus* Dall.

THE ASPARAGUS BEETLE.

Crioceris asparagi Linn.

For detailed account, see Chittenden, Yearbook, U. S. Dept. Agric., 1896, pp. 341–349. For bibliography and general account, see Lintner, 11th Rept. St. Ent. N. Y., pp. 177–188, 1896.

Exhibit: Larva, adult, figure, and enemy, *Stiretrus anchorago* Fab.

THE TWELVE-SPOTTED CUCUMBER BEETLE.

Diabrotica duodecempunctata Ol.

For general accounts and remedies, see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 12–13, 1903; Quaintance, Bul. 26, n. s., Div. Ent., U. S. Dept. Agric., pp. 35–40, 1900.

Exhibit: Adult and figure.

FALSE BUD-WORM; COTTON BOLLWORM.

Heliothis obscura Fab.

(Known also as *Heliothis armiger* Hübn. For full life-history exhibit, see under cotton and corn.)

For life history and general account, see Quaintance, Farmers' Bul. 191, U. S. Dept. Agric., 1904.

Exhibit: Adult.

ZEBRA CATERPILLAR.

Mamestra picta Harr.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 42–43, 1903.

Exhibit: Larva, adult, and figure.

THE PRETTY CUTWORM.

Mamestra legitima Grt.

For brief account see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 24–25, fig. 20, 1900.

Exhibit: Larva, adult, and figure.

CRANBERRY SPANWORM.

Cleora pampinaria Guen.

For general account see Smith, Farmers' Bul. 178, pp. 19–21, 1903.

Exhibit: Larva, pupa, and adult.

THE RED-BANDED LEAF-ROLLER.

Eulia triferana Walk.

(Formerly *Lophoderus.*)

For brief account see Lugger, 4th Rept. State Entom. Minn. p. 231, 1899.

Exhibit: Larva, pupa, and adult.

THE SULPHUR-COLORED TORTRIX.

Epagoge sulfureana Clem.

(Formerly *Dichelia.*)

For brief account see Lugger, 4th Rept. State Entom. Minn., pp. 232–233, 1899.

Exhibit: Pupa and adult.

INSECTS INJURIOUS TO CUCURBITS.

SQUASH-VINE BORER.

Melittia satyriniformis Hübn.

(Formerly *Ægeria cucurbitæ.*)

For life history and general accounts see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 34–40, 1899; Circ. 38, Div. Ent., U. S. Dept. Agric., 1899.

Exhibit: Larva, pupa, cocoon, adult, and figure.

PICKLE WORM.

Diaphania nitidalis Cram.

(Formerly *Eudioptis* and *Margaronia.*)

For general accounts and bibliography see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 40–42, 1899; Lintner, 11th Rpt. N. Y. St. Ent., pp. 126–133, 1896.

Exhibit: Pupa, cocoon, adult, and figure.

MELON CATERPILLAR.

Diaphania hyalinata Linn.

For general accounts and bibliography see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 42–44, 1899; Lintner, 11th Rpt. N. Y. St. Ent., pp. 134–138, 1896.

Exhibit: Larva, pupa, adult, and figure.

NORTHERN LEAF-FOOTED PLANT-BUG.

Leptoglossus oppositus Say.

For life history and general account see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 18–25, 1902.

Exhibit: Nymph, adult, and figure.

STRIPED CUCUMBER BEETLE.

Diabrotica vittata Fab.

For general accounts see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 48–51, 1899; Cir. 31, Div. Ent., U. S. Dept. Agric., 1898.

EXHIBIT: Adult, work, and figure.

TWELVE-SPOTTED CUCUMBER BEETLE.

Diabrotica duodecempunctata Oliv.

For general articles see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 12–13, 1903; Quaintance, Bul. 26, n. s., pp. 35–40, 1900.

EXHIBIT: Adult.

THE CUCUMBER FLEA-BEETLE.

Epitrix cucumeris Harr.

For short account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 89–90, 1899.

EXHIBIT: Adult and figure.

THE PUNCTURED FLEA-BEETLE.

Psylliodes punctulata Mels.

For brief account see Forbes and Hart, 21st Rpt. St. Ent. Ill., p. 124, 1900.

EXHIBIT: Adult.

THE HORNED SQUASH-BUG.

Anasa armigera Say.

For general accounts see Chittenden, Can. Ent., v. XXX, pp. 239–240, 1898; Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 28–34, 1899.

EXHIBIT: Eggs, nymph, adult, and figure.

THE COMMON SQUASH-BUG.

Anasa tristis De G.

For general accounts see Chittenden, Circ. 39, Div. Ent., U. S. Dept. Agric., 1899; Bul. 19, n. s., pp. 20–28, 1899.

EXHIBIT: Eggs, nymph, adult, and figure.

THE SQUASH LADYBIRD.

Epilachna borealis Fab.

For bibliography and life history see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 11–20, 1899.

EXHIBIT: Larva, pupa, adult, and work.

INSECTS INJURIOUS TO OTHER VEGETABLE PRODUCTS.

INJURING CARROT, CELERY, PARSLEY, AND PARSNIP.

THE CELERY LOOPER.

Plusia simplex Guen.

For general account see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 73–74, 1902.

EXHIBIT: Adult and figure.

THE GREENHOUSE LEAF-TYER.

Phlyctaenia ferrugalis Hübn.

For detailed account (under *P. rubigalis* Guen.) see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 7–26, 1901.

EXHIBIT: Larva, cocoon, adult, and figure.

THE CELERY CATERPILLAR.

Papilio polyxenes Fab.

(Formerly called *P. asterias.*)

For general account see Davis, Bul. 102, Mich. Agric. Expt. Sta., pp. 21-24, 1893.

EXHIBIT: Larva, adult and chrysalis.

THE CARROT RUST-FLY.

Psila rosæ Fab.

For general article see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 26–32, 1902.

EXHIBIT: Adult and figure.

THE CARROT BEETLE.

Ligyrus gibbosus DeG.

For general account see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 32–37, 1902.

EXHIBIT: Adult and figure.

THE PARSNIP WEBWORM.

Depressaria heracliana DeG.

For general accounts see Riley, Insect Life, v. I, pp. 94–98, 1888; Southwick, Insect Life, v. V, pp. 106–109, 1892.

EXHIBIT: Larva, pupa, adult, work, and figure.

THE PARSNIP LEAF-MINER.

Acidia fratria Loew.

(Formerly known as *Trypeta.*)

For short account see Coquillett, Insect Life, v. VII, pp. 383–384, 1895.

EXHIBIT: Adult and figure.

THE PARSLEY ROOT-BORER.

Listronotus latiusculus Boh.

For brief notice see Chittenden, Yearbook, U. S. Dept. Agric., 1902, p. 731.

Exhibit: Adult.

THE LITTLE NEGRO BUG.

Corimelæna pulicaria Germ.

For general account see Davis, Bul. 102, Mich. Agric. Expt. Sta., pp. 13–18, 1893.

Exhibit: Nymph and adult.

DARK-SIDED CUTWORM.

Euxoa messoria.

(Formerly *Carneades.*)

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 290–291, pl. 2, fig. 6, 1885.

Exhibit: Adult and figure.

INJURIOUS TO ONION.

THE WHEAT WIREWORM.

Agriotes mancus Say.

For general account see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 77–78, 1901.

Exhibit: Adult and figure.

TOBACCO THRIPS; ONION THRIPS.

Thrips tabaci Lind.

For short accounts as *T. striatus* see Gillette, Bul. 47, Colo. Agric. Expt. Sta., p. 44, 1898; Howard, Farmers' Bul. 120, U. S. Dept. Agric. pp. 24–25, 1900.

Exhibit: Figure.

THE CORN-STALK MAGGOT.

Chætopsis ænea Wied.

For general account see Howard, Insect Life, v. VII, pp. 352–354. 1895.

Exhibit: Pupa and adult.

THE ONION FLY.

Pegomya cepetorum Meade.

For general account as *Phorbia ceparum* see Slingerland, Bul. 78, Cornell Univ. Agric. Expt. Sta., pp. 495–496, 1894.

Exhibit: Adult.

INJURIOUS TO RHUBARB.

THE RHUBARB CURCULIO.

Lixus concavus Say.

For general account see Chittenden, Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 61–69, 1900.

EXHIBIT: Adult and figure.

THE CONVEX FLEA-BEETLE.

Psylliodes convexior Lec.

EXHIBIT: Adult.

INSECTS INJURIOUS TO ORNAMENTAL PLANTS.

For general article on insects affecting ornamental plants see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., 1901.

THE GREENHOUSE LEAF-TYER.

Phlyctænia ferrugalis Hübn.

EXHIBIT: Larva, cocoon, adult, and figure.

THE MORNING-GLORY LEAF-CUTTER.

Loxostege obliteralis Walk.

EXHIBIT: Larva, cocoon, adult, and figure.

THE ROSE BUD-WORM.

Olethreutes nimbatana Clem.

For bibliography and general account see Lintner, 5th Rept. N. Y. St. Ent., pp. 213–215, 1889.

EXHIBIT: Pupa, adult, and figure.

THE VIOLET SAWFLY.

Emphytus canadensis Kby.

EXHIBIT: Adult and figure.

FULLER'S ROSE BEETLE.

Aramigus fulleri Horn.

EXHIBIT: Adult and figure.

THE FICKLE MIDGE.

Sciara inconstans Fitch.

EXHIBIT: Adult and figure.

THE VIOLET "GALL-FLY."

Diplosis violicola Coq.

EXHIBIT: Figure.

THE ROSE CURCULIO.

Rhynchites bicolor Fab.

EXHIBIT: Adult and figure.

CALIFORNIA FLOWER BEETLE.

Hoplia callipyge Lec.

Exhibit: Adult and figure.

THE ROSE LEAF-BEETLE.

Nodonota puncticollis Say.

For general account see Chittenden, Bull. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 60–61, 1897.

Exhibit: Adult.

THE AZALEA BARK SCALE.

Eriococcus azaleæ Comst.

For bibliography, food plants and distribution, see Fernald, Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 72, 1903.

Exhibit: Infested twig.

THE EUONYMUS SCALE.

Chionaspis euonymi Comst.

For bibliography, food-plants, and distribution see Fernald, Coccidae of World, Bul. 88, Mass. Agr. Col., pp. 216, 1903.

Exhibit: Infested twig.

THE ROSE COTTONY SCALE.

Palæococcus rosæ R. & H.

For bibliography, distribution, and food plants, see Fernald, Coccidae of World, Bul. 88 Mass. Agr. Coll., p. 21, 1903. For general account see Riley and Howard, Insect Life, v. III, pp. 93-97, 1890.

Exhibit: Infested twig.

THE BLACK OR BROWN APHIS OF VIOLETS.

Rhopalosiphum violæ Perg.

For original description with short account of injury to violets, see Pergande, Can. Ent. v. XXXII, pp. 29–30, 1900.

Exhibit: Figure.

THE TWO-SPOTTED RED SPIDER.

Tetranychus bimaculatus Harv.

For description and distribution see Banks, Tech. Ser., 8, Div. Ent. U. S. Dept. Agric., pp. 73–74, 1900.

Exhibit: Figure.

THE WHITE ANT.

Leucotermes flavipes Koll.

For general account see Marlatt, Circ. 50, Div. Ent. U. S. Dept. Agric., 1902.

Exhibit: Adult and figure.

INSECTS INJURIOUS TO CRANBERRY.

For treatises on cranberry insects see Smith, Farmers' Bul. 178, U. S. Dept. Agric., 1903; Bul. 90 N. J. Agr. Exp. Sta., 1892; Saunders, Insects Injurious to Fruits, 2d ed., pp. 369–376, 1900.

INJURING THE LEAVES.

LEATHER-COLORED LOCUST.

Acridium alutaceum Harr.

Exhibit: Adult.

THE TWO-STRIPED LOCUST.

Melanoplus bivittatus Say.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 363–368, fig. 5, 1897; Riley, Bul. 25, Div. Ent. U. S. Dept. Agric., pp. 31–32, 1891.

Exhibit: Adult.

THE ANGULAR-WINGED KATYDID.

Microcentrum retinerve Burm.

Exhibit: Adult, eggs and parasitized eggs.

THE CRANBERRY LOOPER.

Xanthotype crocataria Fab.

(Formerly *Angerona.*)

For general account see Lugger, 4th Rpt. State Entom. Minn., pp. 178–179, 1899.

Exhibit: Adult.

CHAIN-SPOTTED GEOMETER.

Cingilia catenaria Dru.

(Formerly *Caterva.*)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 186–187, 1899; Packard, 5th Rept. U. S. Ent. Comm., pp. 783–784, 1890.

Exhibit: Larva, pupa, and adult.

CRANBERRY SPANWORM.

Cleora pampinaria Guen.

(Formerly *Boarmia.*)

For general account see Smith, Farmers' Bul. 178, U. S. Dept. Agric., pp. 19–21, 1903.

Exhibit: Larva, pupa, and adult.

THE YELLOWHEAD CRANBERRY WORM.

Acleris minuta Rob.

(Formerly *Teras.*)

For general account see Smith, Farmers' Bul. 178, U. S. Dept. Agric., pp. 12–17, 1903.

Exhibit: Adult and figure.

THE VINE-WORM; THE FIRE-WORM.

Eudemis vacciniana Pack.

For general account see Smith, Farmers' Bul. 178, U. S. Dept. Agric., pp. 9–12, 1903.

Exhibit: Larva, adult, work, and figure.

INJURING THE STEMS.

THE CRANBERRY GIRDLER.

Crambus hortuellus Hübn.

For general account see Smith, Farmers' Bul. 178, U. S. Dept. Agric., pp. 21–24, 1903.

Exhibit: Adult and figure.

CRANBERRY SCALE; PUTNAM'S SCALE.

Aspidiotus ancylus Putn.

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 252–253, 1903.

Exhibit: Infested twig from fruit tree.

INSECTS INJURING THE FRUIT.

THE CRANBERRY FRUIT WORM.

Mineola vaccinii Riley.

For general account see Smith, Farmers' Bul. 178, U. S. Dept. Agric., pp. 24–26, 1903.

Exhibit: Pupa, cocoon, adult, and figure.

THE CRANBERRY KATYDID.

Scudderia texensis Sauss.

For general account see Smith, Farmers' Bul. 178, U. S. Dept. Agric., pp. 26–29, 1903.

Exhibit: Adult and figure.

INSECTS INJURIOUS TO STRAWBERRY.

For general articles treating of these insects see Forbes, 13th Rpt. Ill. St. Ent., pp. 60–180, 1884; Saunders, Insects Injurious to Fruits, 2d ed., pp. 321–335, 1900.

INJURING THE ROOTS AND CROWN.

THE STRAWBERRY CROWN-GIRDLER.

Otiorhynchus ovatus Linn.

For brief bibliography and account see Lintner, 10th Rpt. St. Ent. N. Y., pp. 416–419, 1895.

Exhibit: Adult.

THE STRAWBERRY CROWN-BORER.

Tyloderma fragariæ Riley.

For detailed accounts see Forbes, 12th Rpt. Ill. St. Ent., pp. 64–75, 1883; 13th Rpt., p. 142, 1884.

EXHIBIT: Adult, work, and figure.

STRAWBERRY CROWN MOTH.

Ægeria rutilans Hy. Edw.

(Formerly *Sesia.*)

For general account see Chittenden, Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 85–90, 1900.

EXHIBIT: Adult, pupa, and work.

THE SPOTTED STRAWBERRY LEAF-BEETLE.

Typophorus canellus Fab.

For general account see Forbes, 13th Rpt. St. Ent. Ill., pp. 159–163, 1884.

EXHIBIT: Adult.

INJURING THE ROOTS.

WHITE GRUB; JUNE BEETLE.

Lachnosterna arcuata Sm.

For general account see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 74–76, 1901.

EXHIBIT: Adult and figure.

THE STRAWBERRY ROOT-BORER.

Graphops nebulosus Lec.

For brief notice see Garman, Bul. 31, Ky. Agric. Exp. Sta., p. 23, 1890.

EXHIBIT: Adult.

INJURING THE LEAVES.

THE STRAWBERRY FALSE-WORM.

Harpiphorus maculatus Nort.

For general account see Harrington, Insect Life, v. II, pp. 227–228, 1890.

EXHIBIT: Larva, pupa, adult, work, and figure.

THE STRAWBERRY LEAF-CHAFER.

Diplotaxis frondicola Say.

For brief account see Kridelbaugh, Ann. Rpt. Ia. St. Hort. Soc., 1871, p. 161, 1872.

EXHIBIT: Adult and work.

THE STRAWBERRY FLEA-BEETLE.

Haltica ignita Illig.

For general account see Chittenden, Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 70–78, 1900.

EXHIBIT: Adult.

THE ROSE LEAF-BEETLE.

Nodonota puncticollis Say.

For general account see Chittenden, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 60–61, 1897.

Exhibit: Adult.

THE DUSKY PLANT-BUG.

Calocoris rapidus Say.

For short account see Lugger, 1st Rpt. St. Ent. Minn., p. 65, 1900.

Exhibit: Adult.

RASPBERRY LEAF-ROLLER.

Exartema permundana Clem.

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 312–313, 1890.

Exhibit: Adult.

THE STRAWBERRY LEAF-ROLLER.

Ancylis comptana Fröhl.

(Formerly *Phoxopteris.*)

For general account see Smith, Bul. 149, N. J. Agric. Expt. Sta., pp. 3–12, 1901.

Exhibit: Larva, pupa, adult, and figure.

THE SMEARED DAGGER.

Apatela oblinita S. & A.

For general account see Packard, 5th Rept. U. S. Ent. Comm., pp. 567–568, 1890.

Exhibit: Larva, adult and figure.

INJURING THE BUDS AND STEMS.

THE STRAWBERRY WEEVIL.

Anthonomus signatus Say.

(Lays eggs in buds and severs stems.)

For general account see Chittenden, Circ. 21, Div. Ent., U. S. Dept. Agric., 1897.

Exhibit: Adult, work, figure, and the parasites *Calyptus tibiator* Cr. and *Catolaccus incertus* Ashm.

INSECTS INJURIOUS TO BLACKBERRY AND RASPBERRY.

For general articles see Webster, Bul. 45, Ohio Agric. Expt. Sta., pp. 151–217, 1893; Saunders, Insects Injurious to Fruits, 2d edit., pp. 303–320, 1900.

INJURING THE ROOTS.

THE RASPBERRY ROOT-BORER.

Bembecia marginata Harr.

For general account see Smith, Spec. Bul. N, N. J. Agric. Expt. Sta., pp. 9–12, 1891.

Exhibit: Larva and adult.

INJURING THE STEMS.

BLACKBERRY GALL-MAKER.

Diastrophus turgidus Bass.

(Also called *D. nebulosus* O. S.)

For brief article see Saunders, Insects Injurious to Fruits, 2d ed., pp. 318–319, 1900.

EXHIBIT: Adult and figure.

RASPBERRY CANE-BORER.

Oberea bimaculata Oliv.

For bibliography and general account see Lintner, 5th Rpt. N. Y. St. Ent., pp. 231–233, 1889.

EXHIBIT: Adult and work.

THE SNOWY TREE-CRICKET.

Œcanthus niveus De G.

For general account see Lugger; 3d Rpt. St. Ent. Minn., pp. 269–271, 1898.

EXHIBIT: Adult, work, and figure.

RED-NECKED CANE-BORER.

Agrilus ruficollis Fab.

For general account see Smith, Spec. Bul. N, N. J. Agric. Expt. Sta., pp. 4–8, 1891.

EXHIBIT: Adult, work, and figure.

INJURING THE LEAVES.

THE RASPBERRY SAWFLY.

Monophadnoides rubi Harris.

For bibliography and general account see Lowe, Bul. 150, N. Y. Agric. Expt. Sta., pp. 249–262, pls. IV–VI, 1898.

EXHIBIT: Larva, adult, and work.

RASPBERRY LEAF-ROLLER.

Exartema permundana Clem.

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 312–313, 1890.

EXHIBIT: Adult.

THE FALL WEBWORM.

Hyphantria cunea Dru.

(Feeds on leaves of various trees, shrubs, and vines.)

For general account see Howard, Farmers' Bul. 99, U. S. Dept. Agric., pp. 20–25, 1899.

EXHIBIT: Adult and figure.

THE SMEARED DAGGER.

Apatela oblinita S. & A.

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 567–568, 1890.

EXHIBIT: Larva and adult.

STRAWBERRY LEAF-ROLLER.

Ancylis comptana Fröhl.

(Formerly *Phoxopteris.*)

For general account see Smith, Bul. 149, N. J. Agric. Expt. Sta., pp. 3–12, 1901.

Exhibit: Pupa and adult.

THE FOUR-MARKED LEAF-BEETLE.

Cryptocephalus quadrimaculatus Say.

Exhibit: Adult.

THE HOODED PLANT-BUG.

Euthoctha galeator Fab.

For brief notices see Riley and Howard, Insect Life, v. I, p. 54, 1888; p. 366, 1889.

Exhibit: Eggs, nymph, and adult.

INJURING THE FRUIT.

RASPBERRY SPAN-WORM.

Synchlora ærata Fab.

(Formerly called *S. glaucaria.*)

For bibliography and general account see Lintner, 8th Rpt. St. Ent. N. Y., pp. 129–133, 1893.

Exhibit: Pupa, adult, and figure.

THE LITTLE NEGRO BUG.

Corimelæna pulicaria Germ.

For general account see Lintner, 8th Rpt. St. Ent. N. Y., pp. 213–214, 1893.

Exhibit: Adult and figure.

INSECTS INJURIOUS TO CURRANT AND GOOSEBERRY.

For general article on insects affecting currant and gooseberry see Piper and Doane, Bul. 36, Washington Agr. Expt. Sta., 1898.

INJURING THE STEMS.

THE TERRAPIN SCALE.

Eulecanium nigrofasciatum Perg.

(Food plants: Apple, birch, linden, maple, peach, plum, sycamore; formerly a *Lecanium.*)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 191, 1903; Pergande, Bul. 18, n. s., Div. Ent. U. S. Dept. Agr., pp. 26–29, figs. 1898.

Exhibit: Infested twig.

THE NATIVE CURRANT STEM-BORER.

Psenocerus supernotatus Say.

For general account see Lugger, 5th Rept. State Entom. of Minnesota, pp. 121–122, 1899.

Exhibit: Adult and work.

CURRANT CLEARWING MOTH; IMPORTED CURRANT-BORER.

Sesia tipuliformis Clerck.

For general account see Lugger, 4th Rpt. State Entom. Minn., pp. 60–64, 1899.

Exhibit: Adult and work.

PUTNAM'S SCALE; CRANBERRY SCALE.

Aspidiotus ancylus Putn.

(Food-plants: Apple, apricot, box-elder, cottonwood, cranberry, elm, hemlock, maple, oak, peach, pear, plum, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 252–253, 1903.

Exhibit: Infested twig.

THE SAN JOSE SCALE.

Aspidiotus perniciosus Comst.

(Food plants: Almond, apple, apricot, birch, black walnut, black currant, catalpa, chestnut, crab apple, crab grass, cherry, grape, hickory, oak, peach, pear, persimmon, plum, poplar, prune, Rocky Mountain cherry, rose, silver maple, willow, and many other plants. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 271–275, 1903; Howard and Marlatt, Bul. 3, n. s., Div. Ent., U. S. Dept. Agr., 1896. 80 pp.

Exhibit: Infested twig.

THE BLACK GOOSEBERRY BORER.

Xylocrius agassizii Lec.

For general accounts see Fletcher, Rept. of Entom. and Bot. for 1898, Can. Dept. Agric., pp. 207–210, 1899; Chittenden, Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 90–92, 1900.

Exhibit: Adult and figure.

INJURING THE LEAVES.

GOOSEBERRY SPANWORM.

Cymatophora ribearia Fitch.

For short account see Lugger, 4th Rpt. State Entom. Minn., pp. 184–186, 1899.

Exhibit: Eggs, larva, pupa, adult, and figure.

IMPORTED CURRANT WORM.

Pteronus ribesii Scop.

(Formerly known as *Nematus ventricosus.*)

For bibliography and technical description see Marlatt, Tech. Series 3, Div. Entom., U. S. Dept. Agric., pp. 61–63, 1896.

EXHIBIT: Adult, figure, and an enemy, *Podisus placidus* Uhl.

THE NATIVE CURRANT WORM.

Pristiphora grossulariæ Walsh.

For bibliography see *Gymnonychus appendiculatus* Htg., Marlatt, Tech. Series 3, Div. Entom., U. S. Dept. Agric., p. 124, 1896.

EXHIBIT: Adult and figure.

THE CRANBERRY LOOPER.

Xanthotype crocataria Fab.

For general account see Lugger, 4th Rpt. State Entom. Minn., pp. 178–179, 1899.

EXHIBIT: Larva and adult.

POLYGONIA PROGNE Cram.

(Formerly *Grapta.*)

For general account see Packard, 5th Rpt. U. S. Entom. Comm., pp. 241, 1890.

EXHIBIT: Larva, chrysalis, and adult.

INJURING THE FRUIT.

GOOSEBERRY FRUIT-WORM.

Zophodia grossulariæ Pack.

For general account see Lugger, 4th Rpt. State Entom. Minn., pp. 214–216, 1899.

EXHIBIT: Pupa and adult.

INSECTS INJURIOUS TO STORED PRODUCTS.

(See also *Calandra oryza*, under Rice.)

THE WOLF MOTH.

Tinea granella Linn.

For general account see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., pp. 31–34, 1897.

EXHIBIT: Pupa and adult.

MEDITERRANEAN FLOUR MOTH.

Ephestia kuehniella Zell.

For general account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., pp. 8–9, 1897.

EXHIBIT: Larva, pupa, cocoon, adult, and figure.

DRIED-CURRANT MOTH.

Ephestia cautella Wlk.

For short account (under *E. cahiritella*) see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., pp. 7–9, 1897.

Exhibit: Larva, adult, and figure.

THE MEAL SNOUT-MOTH.

Pyralis farinalis Linn.

(Formerly *Asopia.*)

For short account see Chittenden, Farmers' Bul. 45, pp. 10–11, 1897.

Exhibit: Larva, pupa, cocoon, and adult.

THE INDIAN-MEAL MOTH.

Plodia interpunctella Hübn.

(Formerly *Ephestia.*)

For general account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., pp. 9–10, 1897.

Exhibit: Larva, pupa, adult, work, and figure.

ANGOUMOIS GRAIN-MOTH.

Sitotroga cerealella Oliv.

(Formerly *Gelechia.*)

For general account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., pp. 6–7, 1897.

Exhibit: Cocoon, adult, work, and figure.

THE FOREIGN GRAIN-BEETLE.

Cathartus advena Waltl.

For short account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., pp. 17–18, 1897.

Exhibit: Adult, work, and figure.

RED OR SQUARE-NECKED GRAIN-BEETLE.

Cathartus gemellatus Duv.

For short account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., p. 17, 1897.

Exhibit: Adult and figure.

THE SAW-TOOTHED GRAIN-BETTLE.

Silvanus surinamensis Linn.

For short account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., pp. 16–17, 1897.

Exhibit: Adult and figure.

THE MERCHANT GRAIN-BEETLE.

Silvanus mercator Fauv.

For short account see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., p. 12, 1897.

Exhibit: Adult.

PHARAXONOTHA KIRSCHII Reitt.

For short notice see Chittenden, Insect Life, v. VII, p. 327, 1895.

Exhibit: Adult.

THE FLAT GRAIN-BEETLE.

Læmophlœus pusillus Sch.

For short account see Chittenden, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., p. 129, 1902.

Exhibit: Adult.

TYPHŒA FUMATA Linn.

Exhibit: Adult and work.

THE BLACK CARPET BEETLE.

Attagenus piceus Oliv.

For general account see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., pp. 15–19, 1897.

Exhibit: Adult.

TROGODERMA TARSALE Mels.

For general account see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., pp. 19–21, 1897.

Exhibit: Adult.

THE CABINET BEETLE.

Anthrenus verbasci Linn.

(Formerly *A. varius.*)

For short account see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., pp. 22–23, 1897.

Exhibit: Adult and work.

THE MEAL SAP-BEETLE.

Carpophilus dimidiatus Fab.

Exhibit: Adult.

THE CORN SAP-BEETLE.

Carpophilus pallipennis Say.

Exhibit: Adult.

THE CADELLE.

Tenebroides mauritanicus Linn.

(Formerly *Trogosita.*)

For general account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., pp. 18–19, 1897.

Exhibit: Larva, adult, work, and figure.

THE DARK MEAL-WORM.

Tenebrio obscurum Fab.

For short account see Chittenden, Farmers' Bul. 45, rev. ed., U. S. Dept. Agric., p. 15, 1897.

Exhibit: Larva, pupa, adult, and figure.

THE YELLOW MEAL-WORM.

Tenebrio molitor Linn.

For general account see Chittenden, Farmers' Bul. 45, rev. ed., U. S. Dept. Agric., pp. 14–15, 1897.

Exhibit: Larva, pupa, adult, and figure.

THE WHITE-MARKED SPIDER-BEETLE.

Ptinus fur Linn.

For general account see Chittenden, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., pp. 127–128, 1902.

Exhibit: Adult.

THE BROWN SPIDER-BEETLE.

Ptinus brunneus Dufts.

For short account see Chittenden, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., p. 128, 1902.

Exhibit: Adult.

THE DRUG-STORE BEETLE.

Sitodrepa panicea Linn.

(Listed as *Anobium* in foreign catalogues.)

For general account see Chittenden, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., pp. 124–126, 1897.

Exhibit: Adult, work and figure.

THE CIGARETTE BEETLE.

Lasioderma testaceum Dufts.

(Formerly *L. serricorne*.)

For general account see Chittenden, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., pp. 126–127, 1897.

Exhibit: Adult and figure.

THE LARGER GRAIN-BORER.

Dinoderus truncatus Horn.

For short account see Chittenden, Insect Life, v. VII, p. 327, 1895.

Exhibit: Adult.

THE RUST-RED FLOUR-BEETLE.

Tribolium ferrugineum Fab.

For general account see Chittenden, Farmers' Bul. 45, rev. ed., U. S. Dept. Agric., pp. 12–13, 1897.

Exhibit: Adult.

THE CONFUSED FLOUR-BEETLE.

Tribolium confusum Duv.

For general account see Chittenden, Bul. 4, n. s., rev. ed., Div. Ent. U. S. Dept. Agric., pp. 113–115, 1902.

Exhibit: Adult and figure.

THE SLENDER-HORNED FLOUR-BEETLE.

Echocerus maxillosus Fab.

For short account see Chittenden, Farmers' Bul. 45, rev. ed., U. S. Dept. Agric., p. 13, 1897.

EXHIBIT: Adult and figure.

THE BROAD-HORNED FLOUR-BEETLE.

Echocerus cornutus Fab.

For short account see Chittenden, Farmers' Bul. 45, rev. ed., U. S. Dept. Agric., p. 13, 1897.

EXHIBIT: Adult and figure.

THE SMALL-EYED FLOUR-BEETLE.

Palorus ratzeburgi Wissm.

For short account see Chittenden, Farmers' Bul. 45., rev. ed., U. S. Dept. Agric., pp. 13–14, 1897.

EXHIBIT: Adult and figure.

THE DEPRESSED FLOUR-BEETLE.

Palorus subdepressus Woll.

EXHIBIT: Adult.

ALPHITOBIUS PICEUS Ol.

EXHIBIT: Adult.

BROAD-NOSED GRAIN WEEVIL.

Caulophilus latinasus Say.

For general account see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., pp. 13–14, 1897.

EXHIBIT: Adult.

THE GRANARY WEEVIL.

Calandra granaria Linn.

(For the most important enemy of stored grain, see *C. oryza*, under "Rice.")

For short account, see Chittenden, Farmers' Bul. 45, rev. ed., U. S. Dept. Agric., pp. 4–5, 1897.

EXHIBIT: Adult, work and figure.

BRACHYTARSUS ALTERNATUS Say.

For life history, notes, and general accounts, see Quaintance, Ent. News, pp. 1–3, plate, 1897.

EXHIBIT: Adult and figure.

HOUSEHOLD INSECTS.

For general account of household insects see Howard, Marlatt, and Chittenden, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., 1902. Contains articles on all the insects represented in the exhibit.

THE HOUSE CENTIPEDE.

Scutigera forceps Raf.

(While this animal is not an insect, but belongs to the class Myriapoda, it is so regularly associated with the insects that it may appropriately be presented with them. It feeds on flies, moths, roaches, etc.)

For general article see Marlatt, Circ. 48, Div. Ent., U. S. Dept. Agric., 1902.

Exhibit: Figure.

THE SILVER FISH.

Lepisma domestica Pack.

For general article see Marlatt, Circ. 49, Div. Ent., U. S. Dept. Agric., 1902.

Exhibit: Figure.

THE BOOK-LOUSE.

Troctes divinatoria Müll.

(Formerly *Psocus* and *Atropos.*)

Exhibit: Figure.

THE WHITE ANT.

Leucotermes flavipes Koll.

(Formerly *Termes.*)

For general account see Marlatt, Circ. 50, Div. Ent., U. S. Dept. Agric., 1902.

Exhibit: Adult and figure.

THE AMERICAN COCKROACH.

Periplaneta americana Linn.

For general article see Marlatt, Circ. 51, Div. Ent., U. S. Dept. Agric., pp. 1–8, 1902.

Exhibit: Adult and figure.

THE BLACK BEETLE.

Blatta orientalis Linn.

For general article see Marlatt, Circ. 51, Div. Ent., U. S. Dept. Agric., pp. 9–10, 1902.

Exhibit: Adult and figure.

THE CROTON BUG.

Blatella germanica Linn.

(Formerly *Ectobia.*)

For general article see Marlatt, Circ. 51, Div. Ent., U. S. Dept. Agric., pp. 10–11, 1902.

Exhibit: Adult.

THE HOUSE CRICKET.

Gryllus domesticus Linn.

Exhibit: Adult.

THE CASE-MAKING CLOTHES MOTH.

Tinea pellionella Linn.

For general article see Marlatt, Circ. 36, Div. Ent., U. S. Dept. Agric., pp. 1–4, 1898.

EXHIBIT: Adult and figure.

THE TAPESTRY MOTH.

Trichophaga tapetzella Linn.

(Formerly *Tinea.*)

For general article see Marlatt, Circ. 36, Div. Ent., U. S. Dept. Agric., p. 5, 1898.

EXHIBIT: Figure.

THE WEBBING CLOTHES MOTH.

Tineola biselliella Hum.

(Formerly *Tinea.*)

For general article see Marlatt, Circ. 36, Div. Ent., U. S. Dept. Agric., pp. 4–5, 1898.

EXHIBIT: Adult and figure.

THE RED-LEGGED HAM BEETLE.

Necrobia rufipes DeG.

(Formerly *Corynetes.*)

EXHIBIT: Adult and figure.

THE LARDER BEETLE.

Dermestes lardarius Linn.

EXHIBIT: Adult and figure.

THE CARPET BEETLE OR "BUFFALO MOTH."

Anthrenus scrophulariæ Linn.

For general article see Howard, Circ. 5, Div. Ent., U. S. Dept. Agric., 1894.

EXHIBIT: Adult and figure.

THE CHEESE OR HAM SKIPPER.

Piophila casei Linn.

EXHIBIT: Adult.

THE FRUIT OR VINEGAR FLY

Drosophila ampelophila Loew.

For general accounts see Howard, Bul. 4, n. s., Div. Ent., U. S. Dept. Agric., pp. 109–111, 1896; Proc. Wash. Acad. Sci., v. II, pp. 589–590, pl. 31, fig. 2, 1900.

EXHIBIT: Adult and figure.

THE LITTLE RED ANT.

Monomorium pharaonis Linn.

For general article see Marlatt, Circ. 34, Div. Ent., U. S. Dept., Agric., pp. 1–2, 1898. For bibliography and general account see Lintner, 11th Rept. N. Y. St. Entom., pp. 109–114, 1896.

EXHIBIT: Adult and figure.

INSECTS WHICH MAY SPREAD DISEASE.

General articles: Howard, Farmers' Bulletin 155, U. S. Dept. Agric., 1902; also Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., pp. 39–45, 1901.

THE YELLOW-FEVER MOSQUITO.

Stegomyia fasciata Fab.

(Is the intermediate host for the parasite of yellow fever. Formerly *Culex.*)

Exhibit: Adult and figure.

THE MALARIA MOSQUITO.

Anopheles maculipennis Meig.

(The most important of the mosquitoes transmitting malaria. Formerly *A. quadrimaculatus.*)

Exhibit: Adult and figure.

THE GREEN BOTTLE FLY.

Lucilia cæsar Linn.

For general article see Howard, Circ. 35, Div. Ent., U. S. Dept. Agric., 1898.

Exhibit: Adult and figure.

THE STABLE FLY.

Stomoxys calcitrans Linn.

For special article see Howard, Proc. Wash. Acad. Sci., v. II, pp. 577–579, fig. 27, 1900.

Exhibit: Adult and figure.

THE HIPPELATES FLY.

Hippelates flavipes Loew.

(Facilitates the spread of the disease known as "pink-eye.")

Exhibit: Adult and figure.

THE BROWN DUNG FLY.

Scatophaga furcata Say.

Exhibit: Adult and figure.

THE SHINING EXCREMENT FLY.

Morellia micans Macq.

Exhibit: Adult and figure.

THE LITTLE HOUSE FLY.

Homalomyia brevis Rond.

Exhibit: Adult and figure.

THE FRUIT OR VINEGAR FLY.

Drosophila ampelophila Loew.

Exhibit: Adult and figure.

THE SCREW-WORM FLY.

Chrysomyia macellaria Fab.

(Formerly *Compsomyia.*)

For special article see Howard, Proc. Wash. Acad. Sci., v. II, p. 562, 1900.

Exhibit: Adult and figure.

THE CATTLE TICK.

Boophilus annulatus Say.

(Very common on cattle below the Texas fever line, and known to be responsible for transmission of Texas fever among cattle.)

Exhibit: Eggs, adult, and figure.

INSECTS WHICH DIRECTLY INJURE OR ANNOY HUMAN BEINGS.

THE HOUSE FLY.

Musca domestica Linn.

For general article see Howard, Circ. 35, Div. Ent., U. S. Dept. Agric., 1898.

Exhibit: Adult and figure.

THE SOUTHERN BUFFALO GNAT.

Simulium pecuarum Riley.

For general article and full life history see Osborn, Bul. 5, n. s., Div. Ent., U. S. Dept. Agric., pp. 41–52, 1896.

Exhibit: Adult and figure.

THE CAT AND DOG FLEA.

Ctenocephalus canis Curtis

(Formerly called *Pulex serraticeps* Gerv.)

For general account see Howard and Marlatt, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., pp. 24–31, 1902. For full bibliography see Baker, Proc. U. S. N. M., v. XXVII, p. 438, 1904.

Exhibit: Figure.

THE BLOOD-SUCKING CONE-NOSE.

Conorhinus sanguisuga Lec.

For general article see Howard and Marlatt, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., pp. 38–42, 1902.

Exhibit: Egg, nymph, adult, and figure.

THE HOUSE MOSQUITO.

Culex pipiens Linn.

For general article and life history see Howard, Bul. 25, n. s., Div. Ent., U. S. Dept. Agric., pp. 22–28, 1900. Treated as *C. pungens* Wied.

Exhibit: Adult and figure.

THE BEDBUG.

Klinophilos lectularia Linn.

(Formerly *Acanthia* and *Cimex.*)

For general article see Marlatt, Circ. 47, Div. Ent., U. S. Dept. Agric., 1902.

Exhibit: Nymph, adult, and figure.

THE BLACK BEETLE.

Blatta orientalis Linn.

For general article see Marlatt, Circ. 51, Div. Ent., U. S. Dept. Agric., pp. 9–10, 1902.

Exhibit: Adult and figure.

THE RED BUG.

Leptus irritans Riley.

For general article see H. Osborn, Bul. 5, n. s., Div. Ent., U. S. Dept Agric., pp. 251–253, 1896.

Exhibit: Figure.

THE HEAD LOUSE.

Pediculus capitis DeG.

For general article see H. Osborn, Bul. 5, n. s., Div. Ent., U. S. Dept. Agric., pp. 166–167, 1896.

Exhibit: Figure.

THE BODY LOUSE.

Pediculus vestimenti Leach.

For general article see H. Osborn, Bul. 5, n. s., Div. Ent., U. S. Dept. Agric., pp. 167–168, 1896.

Exhibit: Figure.

THE CRAB LOUSE.

Phthirius inguinalis Leach.

For general article see H. Osborn, Bul. 5, n. s., Div. Ent., U. S. Dept. Agric., pp. 165–166, 1896.

Exhibit: Eggs, adult, and figure.

INSECTS INJURIOUS TO DOMESTIC ANIMALS.

For general account with illustrations of many of the insects affecting domestic animals see Osborn, Bull. 5, n. s., Div. Ent., U. S. Dept. Agric., pp. 1–302, 1896.

THE SOUTHERN BUFFALO GNAT.

Simulium pecuarum Riley.

Exhibit: Adult and figure.

THE TURKEY GNAT.

Simulium meridionale Riley.

Exhibit: Pupa, adult, and figure.

AMERICAN GAD-FLY.

Tabanus americanus Forst.

Exhibit: Adult.

THE GRAY-STRIPED GREEN-HEAD.

Tabanus lineola Fab.

Exhibit: Adult and figure.

THE BLACK GAD-FLY.

Tabanus atratus Linn.

Exhibit: Larva, adult, figure, and figure of parasite *Phanurus tabanivorus* Ashm.

THE GREENHEAD.

Tabanus costalis Wied.

Exhibit: Adult.

TABANUS EXUL O. S.

Exhibit: Adult.

TABANUS PUNCTIFER O. S.

Exhibit: Adult.

TABANUS CINCTUS Fab.

Exhibit: Adult.

MEXICAN BOT-FLY.

Tabanus mexicanus Linn.

Exhibit: Adult.

THE BLACK-STRIPED GAD-FLY.

Tabanus nigrovittatus Macq.

Exhibit: Adult.

THE BLACK-STRIPED EAR-FLY

Chrysops vittatus Wied.

Exhibit: Adult and figure.

CHRYSOPS ATROPOS O. S.

Exhibit: Adult.

CHRYSOPS HILARIS O. S.

Exhibit: Adult.

THE STABLE FLY.

Stomoxys calcitrans Linn.

For special article see Howard, Proc. Wash. Acad. Sci., v. II, pp. 577–579, fig. 27, 1900.

Exhibit: Adult and figure.

THE HORSE BOT-FLY.

Gastrophilus equi Fab.

Exhibit: Eggs, larva, puparia, adult, and figure.

THE "CHIN" FLY.

Gastrophilus nasalis Linn.

Exhibit: Adult.

THE WARBLE FLY.

Hypoderma bovis **DeG.**

(A European species.)

EXHIBIT: Eggs, adult and figure.

THE OX BOT; OX WARBLE.

Hypoderma lineata **Vill.**

EXHIBIT: Larva, adult, and figure.

THE SHEEP BOT-FLY; HEAD MAGGOT.

Œstrus ovis Linn.

EXHIBIT: Larva, puparia, adult, and figure.

THE HORN FLY.

Hæmatobia serrata **R-D.**

For special article see Riley and Howard, Insect Life, v. II, pp. 93–103.

EXHIBIT: Puparium, adult, and figure.

THE SHEEP TICK.

Melophagus ovinus Linn.

EXHIBIT: Adult and figure.

THE SCREW-WORM FLY.

Chrysomyia macellaria Fab.

(Formerly *Compsomyia.*)

For special article see Howard, Proc. Washington Acad. Sci., v. II, p. 562, 1900.

EXHIBIT: Adult and figure.

THE CAT AND DOG FLEA.

Ctenocephalus canis Curtis.

(Formerly called *Pulex serraticeps* Gerv.)

For full bibliography see Baker, Proc. U. S. N. M., v. XXVII, p. 438, 1904.

EXHIBIT: Figure.

THE SUCKING HORSE-LOUSE.

Hæmatopinus asini Linn.

EXHIBIT: Figure.

THE SHORT-NOSED OX-LOUSE.

Hæmatopinus eurysternus Nitsch.

EXHIBIT: Figure.

THE LONG-NOSED OX-LOUSE.

Hæmatopinus vituli Linn.

EXHIBIT: Adult and figure.

THE CATTLE LOUSE.

Trichodectes scalaris Nitsch.

Exhibit: Adult and figure.

THE SHEEP LOUSE.

Trichodectes sphærocephalus Nitsch.

Exhibit: Adult and figure.

TICKS INJURIOUS TO DOMESTIC ANIMALS.

For general account, bibliography, and illustrations see Salmon and Stiles, Cattle Ticks, 17th Ann. Rept. B. A. I., U. S. Dept. Agric., pp. 380–491, 1900.

THE CATTLE TICK.

Boophilus annulatus Say.

(Very common on cattle below the Texas fever line and known to be responsible for transmission of Texas fever among cattle.)

Exhibit: Adult and figure.

THE SOUTHERN CHICKEN TICK.

Argas miniatus Koch.

(Also reported on cattle.)

Exhibit: Adult and figure.

THE SPINOSE EAR TICK.

Ornithodoros megnini Dugés.

(On man, cattle, horses, dogs, sheep, etc.)

Exhibit: Adult and figure.

THE AMERICAN DOG TICK.

Dermacentor electus Koch.

(On man, cattle, dogs, and horses.)

Exhibit: Adult and figure.

THE NETTED TICK.

Dermacentor reticulatus Fab.

(On man, cattle, horses, and sheep.)

Exhibit: Adult and figure.

THE LONE-STAR TICK.

Amblyomma americanum Linn.

(Not uncommon on cattle and man.)

Exhibit: Adult and figure.

THE CASTOR-BEAN TICK.

Ixodes ricinus Linn.

(On man, cats, dogs, cattle, goats, horses, rabbits, etc.)

Exhibit: Adult and figure.

SPECIAL EXHIBIT OF MODELS OF INSECTS AND OF PLANTS AND INSECTS AFFECTING THEM.

YELLOW FEVER MOSQUITO.

Stegomyia fasciata Fab.

Enlarged model. This mosquito transmits yellow fever and it is now the opinion of the best-posted experts that only through its bite can one contract this disease.

MALARIA MOSQUITO.

Anopheles maculipennis Meig.

Enlarged model. This and other species of Anopheles are the only known transmitters of human malaria. The parasitic organism causing malaria inhabits the red-blood cells of human beings. It is taken with the blood into the stomach of the mosquito. There it undergoes a sexual development, reproduces, and the offspring are carried with the mosquito poison into the circulation of healthy human beings.

SALT MARSH MOSQUITO.

Culex sollicitans Walk.

Enlarged model. This mosquito is not known to carry any disease, but is very annoying at many seaside resorts.

THE HOUSEFLY.

Musca domestica Linn.

Enlarged model. The housefly is not merely a nuisance, but also acts as a carrier of many diseases, especially in the United States of typhoid fever.

HESSIAN FLY.

Cecidomyia destructor Say.

One of the most injurious enemies of wheat in the Northern and Central States. The larva attacks the stem. The average yearly damage to the wheat industry in this country from this insect is $60,000,000.

Enlarged models are exhibited of the adult fly, and of an infested stalk of wheat showing the so-called "flaxseed" stage of the insect.

Two natural-size models are exhibited, one representing a healthy, unaffected young wheat plant to contrast with the same attacked by the Hessian fly; the other illustrating the effects of the attacks of the Hessian fly.

GRAPE-VINE TRUMPET-GALL.

Lasioptera viticola O. S.

Model in wax of the abnormal growths caused by the sting of a minute dipterous insect not infrequently observed on the leaves of the grape.

GRAPE-VINE TOMATO-GALL.

Lasioptera vitis O. S.

Model in wax of the abnormal growths on terminal twigs of the grape, caused by the sting of a little gnat.

GRAPE-VINE PHYLLOXERA-GALL.

Phylloxera vastatrix Planch.

Model in wax of the galls produced by the leaf form of the grape Phylloxera, showing their characteristic appearance and disposition on the leaf.

SOCIAL GRAPE CATERPILLAR.

Harrisina americana Harr.

Twigs of grape-vine modeled in wax, showing the characteristic appearance and work of the larvæ and their method of feeding in uniform rows on the leaf.

THE GRAPE-SEED WEEVIL.

Craponius inæqualis Say.

A bunch of grapes, showing damage to the berries by the larvæ of this insect; also punctures made by the female beetle in oviposition.

THE SILKWORM.

Bombyx (*Sericaria*) *mori* Linn.

Enlarged model of the larva, showing its complete anatomy: the muscles, nerves, trachæ, viscera, the silk apparatus in its whole extent, the silk-secreting gland, and the gland discovered by Auzoux, which secretes a liquid, the use of which is most probably to convert the silky matter into insoluble threads. In one of the prolegs may be seen the muscles which move the claws and sucking disks which enable the animal to walk with its true feet in the air.

Enlarged models of the moths, male and female. In each model is shown the atrophy of the digestive tube and the development of the marvelous organs by which the species is perpetuated. (After Auzoux.)

HOP PLANT-LOUSE.

Phorodon humuli Schr.

UNAFFECTED HOP PLANT.—A spray of hops, modeled in wax, representing the plant as it appears in vigorous growing condition, and free from the attacks of its principal enemy, the hop plant-louse to contrast the stronger foliage and the more abundant and larger hops produced by plants from which the hop louse has been eradicated by the use of proper remedies.

AFFECTED HOP PLANT.—A spray of hops modeled in wax, representing the vine as it appears when attacked by the hop plant-louse, showing the blackening and discoloration of the leaves and the small and inferior hops which are also discolored and otherwise unsuitable for market.

WINTER EGGS. Enlarged model of the winter eggs, which are attached by the sexual female to the terminal twigs of the plum, in crevices around the buds.

STEM-MOTHER. The stout female plant-louse shown in this enlarged model hatches from the winter egg and is characterized by shorter legs and honey-tubes. It gives birth without the intervention of the male to living young, of which three generations are produced on the plum trees, the last being winged and migrating to the hop.

WINGED MIGRANT. —This enlarged model represents the first winged generation, the third produced on the plum. It instinctively flies to the hop plant and is the progenitor of from five to twelve wingless generations of virgin females, which infest the hop plants until autumn, and are the sole forms which depredate on the hop. In autumn the last generation again produces winged females which fly to the plum trees.

HOP-AFFECTING STAGE.—This enlarged model represents the structure and appearance of the five to twelve wingless generations of virgin females which people the hop plant until autumn. These are the progeny of the *winged migrants* and are the sole forms which injure the hop.

RETURN MIGRANT. This enlarged model represents the last generation produced on the hop, the winged migrant form which in September returns again to the plum and gives birth to three or more young, which are the true sexual females, the first perfect sexual females produced in the cycle up to this point.

PUPA OF RETURN MIGRANT.— This model represents the pupal stage of the *return migrant*. The striking features are the wing pads, which with another molt become the ample flight organs seen in the model of the adult.

TRUE SEXUAL FEMALE. —This enlarged model represents the generation born of the return migrant, which never acquire wings and never leave the plum tree. Maturing in a few days, according to the temperature, they are fertilized by the true winged males which have been subsequently developed on the hops, and have come from the hop fields to the plum. Shortly after fertilization the winter eggs, like those with which the cycle started, are deposited.

YOUNG SEXUAL FEMALE.—This enlarged model represents the newly hatched stage of the only perfectly developed sexual female produced in the life cycle of this insect.

WINGED MALE. This enlarged model represents the first and only male generation produced in the life cycle of the hop-plant louse. This is developed in the autumn, and flies from the hop to the plum and fertilizes the true sexual females.

CHINCH BUG.

Blissus leucopterus Say.

The Eggs. This enlarged model represents the form of the egg and the terminal cap. The eggs are three-hundredths of an inch long, the top being squarely docked and surrounded by four round tubercles near the center. Color from pale whitish to amber.

First Larval Stage.—This stage, represented enlarged in this model, differs from the adult in being more elongate and in having two-jointed tarsi, the head broader and more rounded and the joints of the body subequal. The prevailing color of the whole body is red.

Second Larval Stage. After the first molt the form represented in this enlarged model is assumed. The red becomes a brilliant vermilion and contrasts with the pale band across the middle of the body, while the head and prothorax are dusky and coriaceous. Two broad marks appear on the mesothorax and the second, fourth, and fifth abdominal sutures, and one at the tip of the abdomen.

Pupa.—The pupa shown in this enlarged model approaches still more nearly the form of the adult, and is not unlike the last larval stage except in being darker and in the appearance of wing-pads, which extend almost across the pale basal abdominal joints.

The Imago.—The mature insect which is represented enlarged in this model is elongate, blackish, and with numerous hairs, or pubescense. Its length is about three-twentieths of an inch. The outer wings are whitish, with a strong distinctive black spot.

THE SAN JOSE SCALE.

Aspidiotus perniciosus Comst.

Ten enlarged models are exhibited illustrating the life cycle of this pest, which has caused more damage to the fruit industry and been the object of more legislation than any other insect. Its small size and inconspicuous appearance often leave it undetected until the infested trees are beyond recovery. The scale may be killed by fumigation or spraying.

Enlarged models are exhibited of the *first* and *second larval stages*, of the *young crawling larva*, *nearly full-grown larva*, *male pro-pupa*, *male pupa*, *adult male*, *adult female*, and of the *half-grown scale*, *full-grown male scale*, and *full-grown female scale*.

THE ASIATIC LADY-BIRD.

Chilocorus similis Rossi.

Two enlarged models are exhibited illustrating the adult and the larva of this insect, which was introduced by the U. S. Department of Agriculture from China, where it is the important agent in keeping the San José scale in check.

THE CODLING MOTH.

Carpocapsa pomonella Linn.

Four enlarged models illustrating the life history of this insect which is the cause of the "wormy apples." The damage from it in this country is estimated at $11,000,000 annually.

Models are exhibited of the *larva* and of the *adult moth;* and also an enlarged section of a *piece of bark*, cut so as to show a cocoon and pupa of the codling moth beneath it, and an enlarged section of "wormy" apple showing egg, young, and mature larva and their work.

THE MEXICAN COTTON BOLL WEEVIL.

Anthonomus grandis Boh.

Enlarged model. This insect is a native of Cuba and Mexico; upwards of ten years ago the weevils crossed the Rio Grande near Brownsville and have now spread over nearly the entire cotton belt of Texas. Its rapid extension, great destructiveness, and the unusual difficulties in the way of its control have caused grave fears for the future of the cotton industry in the United States. The Federal Government has this year appropriated $250,000 for combating this insect.

THE HONEY BEE.

Apis mellifera Linn.

Enlarged models, reproducing the insect in six different forms—queen, male, wax-worker, worker, bee with propolis, and the bee with pollen. In these are shown the external and internal characters which distinguish each type. Also a model of a comb in the same proportion, in which are seen the cells for honey, for pollen, and for the eggs to produce queens, drones, and workers, with eggs, larvæ, and pupæ in different stages of development. (After Auzoux.)

THE EUROPEAN COCKCHAFER.

Melolontha vulgaris Fab.

Model of the perfect insect enlarged twelve times, showing the muscles, nerves, trachea, and viscera, each model separable into as many pieces as there are organs. More than 600 detailed objects are shown, each indicated by a corresponding number.

FLUTED SCALE.

Icerya purchasi Mask.

Model in wax of a twig of orange infested with the fluted scale (*Icerya purchasi*) copied directly from nature, the actual scales being transferred to the model plant. Illustrates the characteristic appearance of the infested plant.

Model of Noninfested Orange. -The model in wax contrasts with the one representing the characteristic appearance of infested plant.

Illustrations from the publications of the Division of Entomology, representing the different stages of the fluted scale and its principal enemies.

AUSTRALIAN LADYBIRD.

Novius (*Vedalia*) *cardinalis* Muls.

(Principal enemy of the fluted scale [*Icerya purchasi*].)

Enlarged model of the adult of this insect, the introduction of which from Australia has effected what was impossible by any other means the practical annihilation of the fluted scale in California.

Enlarged models showing structure and characteristic appearance of the larva and pupa.

IMPORTED CURRANT WORM.

Pteronus ventricosus Klug.

This wax model of a currant branch illustrates the work of the imported currant worm. For extended exhibit of the insects affecting the currant see regular economic cases.

PLUM CURCULIO.

Conotrachelus nenuphar Hbst.

The work of the plum curculio on the fruit of the plum, apple, pear, cherry, and peach is illustrated by models. For full details as to the work of this insect see exhibit in regular economic series.

Young apples and pears, a twig of cherry and a branch of peach with ripening fruit, and twigs of plum with green and ripening fruit, illustrating the effects of punctures by the female curculio, are shown.

THE "KISSING BUG."

Reduvius personatus Linn.

Enlarged model of one of the group of true bugs, generally known as "assassin bugs," which of late years have acquired a certain newspaper notoriety through their supposed preference for the human lips. They feed on other insects, which they pierce with their strong beaks; some species are frequently found in houses, attracted by light, and they may, if they believe themselves in danger, accidentally or in defense, pierce the human skin with their beaks, causing a painful wound, and often blood poisoning through the introduction of the germs of putrefaction.

ORANGE RUST-MITE.

Eriophyes (*Phytoptus*) *oleivorus* Ashm.

Wax models of oranges, showing work of the orange rust-mite.

THE PARASITE CAUSING MALARIA (ÆSTIVO-AUTUMNAL FEVER).

Plasmodium malariæ.

Twenty-nine enlarged models, illustrating the life history of this parasite in the blood of man and in the mosquito (*Anopheles*).

The models exhibited show: Development of spores in the blood of man; development of "crescent" in the blood of man; development of "gamete" in stomach of mosquito; development and fertilization of "zygote" in stomach of mosquito; development of "zygote" in stomach wall of mosquito; "zygote" filled with "blasts" and ready to burst; free endospores, free blasts, and spermatozoa.

RIKER MOUNTS SHOWING LIFE HISTORIES OF INSECTS.

LEPIDOPTERA.

Eight-spotted Forester.
Alypia octo-maculata Fab.
Grapevine Hog Caterpillar.
Ampelophaga myron Cram.
Stigma Moth.
Anisota stigma Fab.
Spring Maple Worm.
Anisota rubicunda Fab.
Maple Dagger Moth.
Apatela americana Harr.
Io Moth.
Automeris io Fab.
Calleta Silkmoth.
Callosamia calleta Westw.
Prometheus Silkmoth.
Callosamia promethea Dru.
Chainspotted Geometer.
Cingilia catenaria Cram.
Hickory Horned Devil.
Citheronia regalis Fab.
Cranberry Spanworm.
Cleora pampinaria Guen.
Yellow-Necked Caterpillar.
Datana ministra Dru.
Roller Worm.
Eudamus proteus Linn.
Brown-Tail Moth.
Euproctis chrysorrhœa Linn.
Large Beautiful Woodnymph.
Euthisanotia grata Fab.
Mourning Cloak.
Euvanessa antiopa Linn.
Oak Tussock Caterpillar.
Halisidota maculata Harr.
Social Grape Caterpillar.
Harrisina americana Guér.
White-Marked Tussock Moth.
Hemerocampa leucostigma S. & A.
Lunate Looper.
Homoptera lunata Dru.
Fall Webworm.
Hyphantria cunea Dru.
Fall Army Worm.
Laphygma frugiperda S. & A.
The Army Worm.
Heliophila (Leucania) unipuncta Haw.
Apple Tent-Caterpillar.
Malacosoma americana Harr.
The Baltimore.
Euphydryas phæton Dru.
Parsnip Butterfly.
Papilio polyxenes Fab.
Spice-Bush Swallowtail.
Papilio troilus Linn.
Cynthia Silkmoth.
Philosamia cynthia Dru.
Semicolon Butterfly.
Polygonia interrogationis Fab.
Gipsy Moth.
Porthetria dispar Linn.
Tobacco Worm.
Phlegethontius quinquemaculata Haw.
Jorulla Silkmoth.
Rothschildia jorulla Westw.
Orizaba Silkmoth.
Rothschildia orizaba Westw.
Polyphemus Silkmoth.
Telea polyphemus Cram.
The Bagworm.
Thyridopteryx ephemeræformis Steph.
Luna Moth.
Tropæa luna Linn.

ORTHOPTERA.

Walking Stick.

Anisomorpha buprestoides Stöl.

Katydid.

Microcentrum retinerve Burm.

The Soothsayers or Rearhorses.

(Chinese and American Species.)

Paratenodera sinensis Sauss. and *Stagmomantis carolina* Burm.

COLEOPTERA.

Asparagus Beetles.

Crioceris asparagi Linn. and *C. duodecimpunctata* Linn.

Elm Leaf Beetle.

Galerucella luteola Müll.

HEMIPTERA.

Seventeen-Year Locust.

Tibicen septendecim Linn.

SILKMOTHS.

THE JAPANESE SILKMOTH.

Antheræa yamamai Guér.

Exhibit: Cocoon, adult, and figure.

THE IO MOTH.

Automeris io Fab.

Exhibit: Larva, cocoon, and adult.

THE ANGULATED SILKMOTH.

Callosamia angulifera Wlk.

Exhibit: Adult.

THE PROMETHEUS SILKMOTH.

Callosamia promethea Dru.

Exhibit: Larva, cocoon, and adult.

THE CYNTHIA SILKMOTH.

Philosamia cynthia Dru.

Exhibit: Adult.

THE GIANT INDIAN SILKWORM.

Attacus atlas Linn.

Exhibit: Adult.

THE CECROPIA SILKMOTH.

Samia cecropia Linn.

Exhibit: Cocoon, adult, and figure.

THE COLUMBIA SILKMOTH.

Samia columbia Sm.

Exhibit: Cocoon and adult.

THE PACIFIC-COAST SILKMOTH.

Samia rubra Behr.

EXHIBIT: Larva and adult.

THE POLYPHEMUS SILKMOTH.

Telea polyphemus Linn.

EXHIBIT: Cocoon, adult, and figure.

THE LUNA SILKMOTH.

Tropæa luna Linn.

EXHIBIT: Larva, cocoon, and adult.

MISCELLANEOUS EXHIBITS.

SILKWORMS.

The rearing of silkworms will be conducted on a small scale throughout the summer. Eggs will be kept in cold storage, so that all stages, from the egg to the full-grown larva spinning its cocoon, may be seen at any time during the season.

LIVING INSECTS.

By means of aquaria, vivaria, and other forms of insect cages living insects will be on exhibit, feeding on their natural food plants and undergoing their usual transformations.

Some of the more important economic species injuring cotton and apple will be reared on growing specimens of these plants. In the smaller aquaria may be seem stages of some of the species of mosquitoes frequenting St. Louis and vicinity.

There will also be exhibited one box illustrating the methods of mounting insects for shipment and for permanent preservation in collections; also numerous photographs showing spraying machinery, reeling of silk from cocoons, silk machinery, etc.

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O

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF ENTOMOLOGY—BULLETIN No. 47.

(Revised Edition.)

L. O. HOWARD, Entomologist.

CATALOGUE

OF THE

EXHIBIT OF ECONOMIC ENTOMOLOGY

AT THE

LOUISIANA PURCHASE EXPOSITION, ST. LOUIS, MO., 1904.

COMPILED UNDER THE DIRECTION OF THE ENTOMOLOGIST

BY

E. S. G. TITUS AND F. C. PRATT.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Entomology,
Washington, D. C., September 1, 1904.

Sir: I have the honor to transmit herewith for publication the accompanying revised copy of Bulletin No. 47, of this Bureau, a catalogue of the exhibit made by the Bureau of Entomology at the Louisiana Purchase Exposition.

Respectfully,

L. O. Howard,
Entomologist.

Hon. James Wilson,
Secretary of Agriculture.

INTRODUCTION.

The following catalogue of the exhibit of economic entomology made by the Bureau of Entomology, U. S. Department of Agriculture, at the Louisiana Purchase Exposition, has been prepared with a view of increasing the usefulness of the exhibit from an economic and educational standpoint, and it is intended to supplement the exhibit by giving bibliographical references which will enable persons interested readily to gain information additional to that conveyed by the label. The general supervision of the preparation of the exhibit itself was placed by the writer in the hands of Mr. August Busck, assistant in the Bureau of Entomology, and in this laborious task he has had the valuable expert assistance of Mr. F. C. Pratt and Mr. E. S. G. Titus, also assistants in the Bureau. The catalogue itself has been compiled by Messrs. Titus and Pratt. The present catalogue does not include a consideration of the exhibit of insects injurious to forest trees, which will be published as a separate pamphlet (Bulletin 48) on account of the desirability of independent distribution of this portion of the catalogue to persons interested in forestry matters.

The Division of Entomology has been represented at many international expositions, its first serious attempt to represent its work in this way having been made at the New Orleans Cotton Exposition of 1884. It was represented by large collections at the subsequent World's Fair at Chicago, at the International Exposition at Paris, at the expositions at Atlanta, Nashville, Omaha, Buffalo, and Charleston. The present exhibit, however, is, in many respects, a more interesting one than any of its predecessors. An effort has been made to illustrate in all of their stages the principal insects injurious to North American crops. Further attempts have been made to show the economic relations of insects in other respects and, on account of the great current interest in the subject of the spread of disease by insects, more attention has been paid to this subject than ever before. Special cases illustrating insects of the greatest immediate popular interest have been prepared, and a series of models of the most prominent economic insects of the day is shown. An effort has been made to introduce a novel feature in this exhibit, namely, living insects feeding under as natural conditions as possible, which will probably prove of quite as great interest to visitors as the illustrative cases of dried specimens.

In the bibliographical references under the titles of the individual exhibits in this catalogue the most comprehensive general articles have been indicated, and especial care has been taken to quote such publications as are most accessible. Reference to many of the earlier articles may be found in Bul. 31, Div. Ent., U. S. Dept. Agric., 1893, this being an index to the exhibit at the World's Columbian Exposition. In the systematic index the more important recent changes in entomological nomenclature have been cared for by cross references from old names to new names for both genera and species.

Persons desiring further information than can be gained from this catalogue or from conversation with the attendant in charge of exhibit are requested to address the writer at the U. S. Department of Agriculture, Washington, D. C.

L. O. Howard,
Entomologist.

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CATALOGUE OF THE EXHIBIT OF ECONOMIC ENTOMOLOGY AT THE LOUISIANA PURCHASE EXPOSITION.

INSECTS INJURIOUS TO ORANGE AND LEMON.

For general articles relating to insects affecting these fruits see Hubbard, 1885, and Insects Affecting the Orange, U. S. Dept. Agric., Marlatt, Scale Insects and Mites of Citrus Fruits, Farmers' Bul. 172, 1903.

THE APPLE TWIG-BEETLE.

Stephanoderes hispidulus Lec.

(Formerly *Hypothenemus eruditus* auct.)

EXHIBIT: Adult and work.

THE OAK AMBROSIA BEETLE.

Xyleborus affinis Eichh.

For general account see Hubbard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 19–20, 1897, under *X. pubescens* Zimm.

EXHIBIT: Adult, work, and figure.

THE PAN-AMERICAN PLATYPUS.

Platypus compositus Say.

For general article see Hubbard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 14–16, 1897.

EXHIBIT: Adult, work, and figure.

FULLER'S ROSE BEETLE.

Aramigus fulleri Horn.

For general account of life history see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 88–96, 1901.

EXHIBIT: Adult.

THE COFFEE-BEAN WEEVIL.

Aræcerus fasciculatus De G.

For partial life history and general account see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., pp. 36–38, 1897.

EXHIBIT: Adult and work.

THE ORANGE CHRYSOBOTHRIS.

Chrysobothris chrysœla Ill.

Exhibit: Adult.

EPITRAGUS TOMENTOSUS Lec.

Exhibit: Adult.

PACHNÆUS DISTANS Horn.

Exhibit: Adult.

ORANGE LEAF-NOTCHER.

Artipus floridanus Horn.

Exhibit: Adult and work.

THE ORANGE SAWYER.

Elaphidion inerme Newm.

For general account see Chittenden, Bul. 18, n. s., Div. Ent., U. S. Dept. Agric., p. 41, 1898.

Exhibit: Adult and work.

LEPTOSTYLUS BIUSTUS Lec.

Exhibit: Adult and work.

THE ORANGE DOG; HOG CATERPILLAR.

Papilio thoas Linn.

(Formerly *P. cresphontes.*)

For brief account of larva see Lintner, 9th Rpt. State Ent. N. Y., pp. 336–337, 1893.

Exhibit: Eggs, larva, chrysalis, adult, and figure.

ORANGE LEAF-ROLLER.

Platynota rostrana Walk.

Exhibit: Eggs, pupa, and adult.

THE SADDLE-BACK CATERPILLAR.

Sibine stimulea Clem.

(Formerly *Empretia.*)

For general account see Lugger, 4th Rpt. State Ent. Minn., pp. 98–99, 1899.

Exhibit: Pupa, adult, and figure.

THE COMMON BAGWORM.

Thyridopteryx ephemeræformis Steph.

For general account see Packard, 5th Rpt. U. S. Ent. Com., pp. 258–262, 1890.

Exhibit: Larva, cocoon, adult, and figure.

THE STINGING CATERPILLAR.

Megalopyge opercularis S. and A.

For short account see Lugger, 4th Rpt. State Ent. Minn., pp. 95–96, 1899.

Exhibit: Cocoon and adult.

THE SKIFF CATERPILLAR.

Prolimacodes scapha Harr.

(Larva feeds on leaves.)

Exhibit: Adult.

THE ORANGE CASE-BEARER.

Eurycyttarus confederata Grt.

(Larvæ feed upon lichens on tree trunk, occasionally gnawing fruit; formerly *Psyche.*)

Exhibit: Cases on twig.

THE TWO-SPOTTED RED SPIDER.

Tetranychus mytilaspidis Riley.

For description and distribution see Banks, Tech. series 8, Div. Ent., U. S. Dept. Agric., pp 71–72, 1900.

For general account of *T. bimaculatus* see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 35–42, 1901.

Exhibit: Figure.

THE ORANGE WHITE SPOT.

Tetranychoides californica Bks.

For description see Banks, Journ. N. Y. Ent. Soc., v. XII, p. 54, pl. II, fig. 1, 1904.

Exhibit: Work and figure.

THE ORANGE FRUIT MITE.

Tenuipalpus californicus Bks.

For description see Banks, Journ. N. Y. Ent. Soc., v. XII, p. 55, pl. II, fig. 2, 1904.

Exhibit: Work and figure.

RUST MITE OF THE ORANGE; THE SILVER MITE OF THE LEMON.

Eriophyes oleivorus Ashm.

(Formerly *Phytoptus.*)

Exhibit: Figure.

THE TWO-STRIPED WALKING-STICK.

Anisomorpha buprestoides Stäl.

Exhibit: Nymph and adult.

THE ANGULAR-WINGED KATYDID.

Microcentrum retinerve Burm.

Exhibit: Eggs, adult, and parasitized eggs.

NORTHERN MOLE CRICKET.

Gryllotalpa borealis Burm.

Exhibit: Nymph and adult.

THE LUBBER GRASSHOPPER.

Dictyophorus reticulatus Thunb.

For brief account see Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agr., pp. 28–29, 1901.

Exhibit: Nymph and adult.

THE COTTON STAINER.

Dysdercus suturellus H-Schf.

For short accounts see Howard, Farmers' Bul. 47, U. S. Dept. Agric., pp. 30–31, 1897; Insect Book, p. 308, fig. 201 and pl. 31, fig. 15, 1901.

Exhibit: Nymph, adult, and figure.

EUTHOCTHA GALEATOR Fab.

Exhibit: Adult.

THE SOUTHERN LEAF-FOOTED PLANT-BUG.

Leptoglossus phyllopus Linn.

For general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 46–48, 1899.

Exhibit: Adult.

EUSCHISTUS SERVUS Say.

Exhibit: Adult.

NEZARA HILARIS Say.

Exhibit: Adult.

WHITE FLY; MEALY WING.

Aleyrodes citri R. & H.

For general account see Marlatt, Farmers' Bul. U. S. Dept. Agric., 172, pp. 36–38, 1903.

Exhibit: Adult, work and figure.

ORANGE APHIS; COTTON APHIS.

Aphis gossypii Glover.

(Curls leaves and stops young growth; usually well controlled by parasites and other enemies.)

For short account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 58–61, 1903.

Exhibit: Eggs, adult, work, figure, and the enemies: *Baccha clavata*, *Hemerobius* sp., *Chrysopa plorabunda*, and a hymenopterous parasite.

COTTONY CUSHION SCALE; FLUTED SCALE.

Icerya purchasi Mask.

(Food plants: Acacia, cypress, grasses, lemon, orange, pine, rose; see under "The more important scale insects" for life history and enemies.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 25–27, 1903.

Exhibit: Infested twig.

THE DESTRUCTIVE MEALY-BUG.

Pseudococcus citri Risso.

(Formerly *Dactylopius destructor*.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 99–100, 1903.

Exhibit: Infested leaves.

THE LONG-SPINED MEALY-BUG.

Pseudococcus longispinus Targ.

(Formerly *Dactylopius* spp. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 104–105, 1903.

Exhibit: Infested leaves.

THE FLORIDA WAX-SCALE.

Ceroplastes floridensis Comst.

(Food plants: Citrus, fig, myrtle, oleander.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 157, 1903.

Exhibit: Infested leaves.

THE BARNACLE SCALE.

Ceroplastes cirripediformis Comst.

(Food plants: Myrtle, orange, persimmon, quince.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 150, 1903.

Exhibit: Infested leaves.

THE SOFT SCALE.

(Food plants: Laurel, lemon, myrtle, oleander, orange, etc.: formerly *Lecanium;* see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 168–170, 1903.

Exhibit: Infested twig.

THE HEMISPHERICAL SCALE.

Saissetia hemisphærica Targ.

(Food plants: Oleander, orange, peach, etc.; formerly *Lecanium;* see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 202–203, 1903.

Exhibit: Infested twig.

THE BLACK SCALE.

Saissetia oleæ Bern.

(Food plants: Apple, apricot, olive, orange, pear, plum, rose; formerly *Lecanium;* see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 205–206, 1903.

Exhibit: Infested twig.

THE OLEANDER SCALE.

Aspidiotus hederæ Vall.

(Food plants: Currant, box, cherry, olive, oleander, orange, etc.; formerly *A. nerii* Bouché; see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 260–264, 1903.

Exhibit: Infested twig.

THE ORANGE CHIONASPIS.

Chionaspis citri Comst.

(Food plants: Euonymus, orange, palms; see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bull. 88, Mass. Agr. Coll., pp. 214–215, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 270, 1901.

Exhibit: Infested twig.

THE RED SCALE OF CALIFORNIA.

Chrysomphalus aurantii Mask.

(Food plants: Agave, apple, fig, grape, lemon, orange, pear, plum, quince, willow, etc., formerly *Aspidiotus*; see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 287–288, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 268, 1901.

Exhibit: Infested twig.

THE CIRCULAR SCALE.

Chrysomphalus ficus Ashm.

(Food plants: Lemon, oleander, orange, palm, rose, etc.; see under "More important scale insects.")

For bibliography and food plants see *Chrysomphalus aonidum*, Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 286–287, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 269, 1901.

Exhibit: Infested twig.

THE PURPLE SCALE.

Lepidosaphes beckii Newm.

(Food plants; Citron, fig, lemon, oak, orange. Formerly known as *Mytilaspis citricola* Glov.; see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 305–306, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 261, 1901.

Exhibit: Infested twig.

GLOVER'S SCALE; LONG SCALE.

Lepidosaphes gloveri Pack.

(Food plants: Lime, magnolia, orange, palms; formerly *Mytilaspis;* see under "More important scale insects," for figures and enemies.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 309, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 265, 1901.

Exhibit: Infested twig.

THE CHAFF SCALE.

Parlatoria pergandei Comst.

(Food plants: Japonica, lemon, orange; see under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 319–320, 1903; Marlatt, Yearbook U. S. Dept. Agric., 1900, p. 270, 1901.

Exhibit: Infested twigs.

THE MORE IMPORTANT SCALE INSECTS.

COTTONY CUSHION SCALE; FLUTED SCALE.

Icerya purchasi Mask.

(Food plants: Acacia, cypress, grasses, lemon, orange, pine, rose; etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 25–27, 1903.

Exhibit: Infested twigs, illustrations and enemies: *Chilocorus cacti*, *Corizus hyalinus*, *Novius cardinalis*, and *Piesma cinerea.*

THE LONG-SPINED MEALY-BUG.

Pseudococcus longispinus Targ.

(Formerly *Dactylopius* spp.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 104–105, 1903.

Exhibit: Infested leaves and figures.

THE DESTRUCTIVE MEALY-BUG.

Pseudococcus citri Risso.

(Formerly *Dactylopius destructor.*)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 99–100, 1903.

Exhibit: Infested leaves.

COTTONY MAPLE SCALE.

Pulvinaria innumerabilis Rathv.

(Food plants: Alder, apple, box-elder, elm, grape, linden, maples, oak, willow, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 134–135, 1903; Howard, Bul. 22, n. s. Div. Ent. U. S. Dept. Agric., pp. 8–16, 1900, figs.

Exhibit: Infested twigs and figures.

THE BARNACLE SCALE.

Ceroplastes cirripediformis Comst.

(Food plants: Myrtle, orange, persimmon, quince.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 150, 1903.

Exhibit: Infested twig.

THE FLORIDA WAX-SCALE.

Ceroplastes floridensis Comst.

(Food plants: Citrus, fig, myrtle, oleander.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 157, 1903.

Exhibit: Infested twigs.

THE SOFT SCALE.

Coccus hesperidum Linn.

(Food plants: Laurel, lemon, myrtle, oleander, orange, etc.; formerly *Lecanium.*)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 168–170, 1903.

Exhibit: Infested twigs and figures.

THE TERRAPIN SCALE.

Eulecanium nigrofasciatum Perg.

(Food plants: Apple, birch, linden, maple, peach, plum, sycamore; formerly *Lecanium.*)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 191, 1903; Pergande, Bul. 18, n. s. Div. Ent., U. S. Dept. Agric., pp. 26–29, 1898, figs.

Exhibit: Infested twig and figures.

THE HEMISPHAERICAL SCALE.

Saissetia hemisphærica Targ.

(Food plants: Oleander, orange, peach, etc.; formerly *Lecanium.*)

For bibliograpy and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 202–203, 1903.

Exhibit: Infested twig.

THE BLACK SCALE.

Saissetia oleæ Bern.

(Food plants: Apple, apricot, olive, orange, pear, plum, rose; formerly *Lecanium.*)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 205–206, 1903.

Exhibit: Infested twig, and parasite *Coccophagus cognatus* How.

THE ORANGE CHIONASPIS.

Chionaspis citri Comst.

(Food plants: Enonymus, orange, palms, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 214–215, 1903; Marlatt, Yearbook, U. S. Dept. Agric., f. 1900, p. 270, 1901.

Exhibit: Infested twig.

THE SCURFY BARK-LOUSE.

Chionaspis furfura Fitch.

(Food plants: Apple, cherry, currant, elm, pear, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 217–219, 1903; Howard, Yearbook, U. S. Dept. Agric., f. 1894, pp. 259–261, 1895, figs.; Banks, Bul. 34, Div. Ent., U. S. Dept. Agric., p. 14, 1902.

Exhibit: Infested twig and figures.

THE WEST INDIAN PEACH SCALE.

Diaspis pentagona Targ.

For bibliography and partial list of food plants under *Aulacaspis* see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 234–235, 1903; Riley and Howard, Ins. Life, Vol. VI, pp. 287–295, 1894, figs.; Banks, Bul. 34, Div. Ent., U. S. Dept. Agric., p. 21, 1902.

Exhibit: Infested twigs and figures.

THE ROSE SCALE.

Aulacaspis rosæ Bouche.

(Food plants: Blackberry, mango, myrtle, pear, raspberry, rose, Cycas, Ailanthus, etc.)

For bibliography see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 236, 1903; Banks, Bul. 34, Div. Ent., U. S. Dept. Agric., p. 23, 1902.

Exhibit: Infested twig and figure.

THE HORSE-CHESTNUT SCALE.

Aspidiotus æsculi Johns.

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 251–252, 1903.

Exhibit: Infested twigs.

PUTNAM SCALE; CRANBERRY SCALE.

Aspidiotus ancylus Putn.

(Food plants: Apple, apricot, box-elder, cottonwood, cranberry, elm, hemlock, maple, oak, peach, pear, plum, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 252–253, 1903.

EXHIBIT: Infested twig.

THE LINDEN SCALE.

Aspidiotus diffinis Newst.

(Food plants: Basswood, lilac.)

For bibliography see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 257, 1903.

EXHIBIT: Infested twigs.

THE EUROPEAN FRUIT SCALE.

Aspidiotus ostreæformis Curt.

(Food plants: Apple, cherry, maple, oak, peach, pear, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 268–270, 1903.

EXHIBIT: Infested twig and figures.

THE CHERRY; FORBES' SCALE.

Aspidiotus forbesi Johns.

(Food plants: Apple, cherry, currant, honey locust, peach, pear, plum, walnut, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 259–260, 1903.

EXHIBIT: Infested twig and figure.

THE GRAPE SCALE.

Aspidiotus uvæ Comst.

(Food plants: Grape, hickory.)

For bibliography see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 280, 1903.

EXHIBIT: Infested twig and figure.

THE WALNUT SCALE.

Aspidiotus juglans-regiæ Comst.

(Food plants: Ash, cherry, crab apple, currant, English walnut, locust, peach, pear, prune, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 265, 1903.

EXHIBIT: Infested twig and figure.

PALM SCALE.

Aspidiotus lataniæ Sign.

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 266–267, 1903.

Exhibit: Infested twig and leaves.

THE SAN JOSE SCALE.

Aspidiotus perniciosus Comst.

(Food plants: Almond, apple, apricot, birch, black walnut, black currant, catalpa, chestnut, crab apple, crab grass, cherry, grape, hickory, oak, peach, pear, persimmon, plum, poplar, prune, Rocky Mountain cherry, rose, silver maple, willow, and many other plants.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 271–275, 1903; Howard and Marlatt, Bul. 3, n. s. Div. Ent. U. S. Dept. Agric., 1896, 80 pp.

Exhibit: Infested twig, fruit, figures, and enemies: *Smilia misella* Lec., adult and figure; *Chilocorus similis* Rossi, larva, pupa, adult, and figure; parasite *Aphelinus diaspidis* How., adult and figure.

THE GREEDY SCALE.

Aspidiotus rapax Comst.

(Food plants: Cottonwood, maple, olive, pear, quince, apple, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 276–278, 1903.

Exhibit: Infested twig and figure.

THE OLEANDER SCALE.

Aspidiotus hederæ Vall.

(Food plants: Currant, box, cherry, olive, oleander, orange, etc.; formerly *A. nerii* Bouché.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 260–264, 1903.

Exhibit: Infested twig and figure.

THE CIRCULAR SCALE.

Chrysomphalus ficus Ashm.

(Food plants: Lemon, oleander, orange, palm, rose, etc.; formerly *Aspidiotus*.)

For bibliography and food plants see *Chrysomphalus aonidum*. Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 286–287, 1903; Marlatt, Yearbook U. S. Dept. Agric. f. 1900, p. 269, 1901.

Exhibit: Infested twig and figure.

THE CALIFORNIA RED SCALE.

Chrysomphalus aurantii Mask.

(Food plants: Agave, apple, fig, grape, lemon, orange, pear, plum, quince, willow, etc.; formerly *Aspidiotus.*)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 287–288, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 268, 1901.

Exhibit: Infested twig and figure.

GLOVER'S SCALE; LONG SCALE.

Lepidosaphes gloveri Pack.

(Food plants: Lime, magnolia, orange, palms; formerly *Mytilaspis.*)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 309, 1903; Marlatt, Yearbook, U. S. Dept. Agric, 1900, p. 265, 1901.

Exhibit: Infested twig, figures, and the following enemies: *Chilocorus bivulnerus* Muls., *C. cacti* Linn., *Coccinella abdominalis* Say, *C. californica* Mann., *C. sanguinea* Linn., *C. oculata* Fabr., *Dakruma coccidivora* Comst., *Exochomus contristatus* Muls., *Hippodamia ambigua* Lec., *H. convergens* Guen., *Hyperaspidius coccidivora* Ashm., *Scymnus bioculatus* Muls., *S. cervicalis* Muls.

OYSTER-SHELL BARK-LOUSE.

Lepidosaphes ulmi Linn.

(Attacks principally apple, currant, Cornus, cottonwood, lilac, pear, sassafras, etc.; formerly *Mytilaspis pomorum* Bouché.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 314–317, 1903.

Exhibit: Infested twig and figure.

THE PURPLE SCALE.

Lepidosaphes beckii Newm.

(Food plants: Citron, fig, lemon, oak, orange; formerly known as *Mytilaspis citricola* Glov.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 305–306, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 261.

Exhibit: Infested twig and figure.

THE CHAFF SCALE.

Parlatoria pergandei Comst.

(Food plants: Japonica, lemon, orange.)

For bibliography and food-plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 319–320, 1903; Marlatt, Yearbook, U. S. Dept. Agric., 1900, p. 270.

Exhibit: Infested twigs and figure.

WHITE FLY; MEALY WING.

Aleyrodes citri R. & H.

For general articles see Marlatt, Farmers' Bul. 172, U. S. Dept. Agric., pp. 36–38, 1903; also Ins. Life, v. V, pp. 219–226, 1893.

Exhibit: Adult, work, and figure.

INSECTS INJURIOUS TO APPLE.

For special treatises on apple insects see Bruner, Trans. Nebr. St. Hort. Soc. f. 1894, pp. 155–223, 1895; Harvey and Munson, Bul. 56, Maine Agr. Expt. Sta., 1899; Saunders, Insects Injurious to Fruits, 2d ed., pp. 13–139, 1900.

INJURING THE ROOTS.

THE WOOLLY APPLE APHIS.

Schizoneura lanigera Hausm.

For general account see Marlatt, Cir. 20, Div. Ent., U. S. Dept. Agric., 1897.

Exhibit: Work, figure, parasite, *Aphelinus mali* Hal.; and enemy *Scymnus cervicalis* Muls.

INJURING THE TRUNK.

FLAT-HEADED APPLE-TREE BORER.

Chrysobothris femorata Fab.

For general account see Chittenden, Cir. 32, Div. Ent., U. S. Dept. Agric., pp. 9–12, 1898.

Exhibit: Adult, work, and figure.

ROUND-HEADED APPLE-TREE BORER.

Saperda candida Fab.

For general account see Chittenden, Cir. 32, Div. Ent., U. S. Dept. Agric., pp. 1–8, 1898.

Exhibit: Adult, work, and figure.

APPLE-WOOD STAINER; PIN-BORER.

Pterocyclon mali Fitch.

(Formerly *Monarthrum*.)

For general account of this and an allied species, *M. fasciatum*, see Hubbard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 26–28, 1897.

Exhibit: Adult and figure.

INJURING THE BRANCHES.

THE APPLE-TREE PRUNER.

Elaphidion villosum Fabr.

For full account and food plants see Chittenden, Bul. 18, n. s., Div. Ent., U. S. Dept. Agric., pp. 35–40, 1898.

Exhibit: Adult, work, and figure.

THE NEW YORK WEEVIL.

Ithycerus noveboracensis Först.

For general account see Lugger, 5th Rpt. St. Ent. Minn., pp. 187–189, 1899.

Exhibit: Adult and work.

THE APPLE TWIG-BORER.

Amphicerus bicaudatus Say.

For general account see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 11–13, fig., 1898.

Exhibit: Adult, work, and figure.

THE APPLE TWIG-BEETLE.

Stephanoderes hispidulus Lec.

(Formerly *Hypothenemus.*)

Exhibit: Adult and work.

PEAR-BLIGHT BEETLE; SHOT-BORER.

Xyleborus pyri Peck.

(Formerly *X. dispar.*)

For general account see Hubbard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 22–23, 1897.

Exhibit: Adult and work.

THE COSMOPOLITAN AMBROSIA BEETLE.

Xyleborus saxeseni Ratz.

(Formerly *X. xylographus.*)

For general account see Hubbard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 24–26, 1897.

Exhibit: Adult.

FRUIT-TREE BARK BEETLE; THE SHOT-HOLE BORER.

Scolytus rugulosus Ratz.

For general account see Chittenden, Cir. 29, Div. Ent., U. S. Dept. Agric., 1898.

Exhibit: Adult and figure.

THE BUFFALO TREE-HOPPER.

Ceresa bubalus Say.

For general account see Marlatt, Cir. 23, Div. Ent., U. S. Dept. Agric., 1897.

Exhibit: Adult, work, and figure.

THE PERIODICAL CICADA.

Tibicen septendecim Linn.

(See special case containing life history, with illustrations of this insect and its work.)

For life history and general article see Marlatt, Bul. 14, n. s., Div. Ent., U. S. Dept Agric., 1898.

Exhibit: Pupa, pupa skins, and adult.

THE SAN JOSE SCALE.

Aspidiotus perniciosus Comst.

(Food plants: Almond, apple, apricot, birch, black walnut, black currant, catalpa, chestnut, crab apple, crab grass, cherry, grape, hickory, oak, peach, pear, persimmon, plum, poplar, prune, Rocky Mountain cherry, rose, silver maple, willow, and many other plants. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 271–275, 1903; Howard and Marlatt, Bul. 3, n. s., Div. Ent., U. S. Dept. Agric., 1896. 80 pp.

Exhibit: Infested twig.

PUTNAM SCALE; CRANBERRY SCALE.

Aspidiotus ancylus Putn.

(Food plants: Apple, apricot, box elder, cottonwood, cranberry, elm, hemlock, maple, oak, peach, pear, plum, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 252–253, 1903.

Exhibit: Infested twig.

THE CHERRY SCALE; FORBES' SCALE.

Aspidiotus forbesi Johns.

(Food plants: Apple, cherry, currant, honey locust, peach, pear, plum, walnut, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 259–260, 1903.

Exhibit: Infested twig.

THE GREEDY SCALE.

Aspidiotus rapax Comst.

(Food plants: Cottonwood, maple, olive, pear, quince, apple, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 276–278, 1903.

Exhibit: Infested twig.

THE EUROPEAN FRUIT-SCALE.

Aspidiotus ostreæformis Curt.

(Food plants: Apple, cherry, maple, oak, peach, pear, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 268–270, 1903.

Exhibit: Infested twig.

THE SCURFY BARK LOUSE.

Chionaspis furfura Fitch.

(Food plants: Apple, cherry, currant, elm, pear, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 217–219, 1903; Howard, Yearbook, U. S. Dept. Agric., 1894, pp. 259–261, figs.; Banks, Bul. 34, Div. Ent., U. S. Dept. Agric., p. 14, 1902.

Exhibit: Infested twig.

OYSTER-SHELL BARK-LOUSE.

Lepidosaphes ulmi Linn.

(Attacks principally apple, currant, Cornus, cottonwood, lilac, pear, sassafras, etc. Formerly *Mytilaspis pomorum* Bouché. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 314–317, 1903.

Exhibit: Infested twig.

THE BLACK SCALE.

Saissetia oleæ Bern.

(Food plants: Apple, apricot, olive, orange, pear, plum, rose; formerly a Lecanium. See under " More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 205–206, 1903.

Exhibit: Infested twig.

INJURING THE LEAVES.

PISTOL CASE-BEARER.

Coleophora malivorella Riley.

(Feeds on leaves and buds.)

For general account see Slingerland, Bul. 124, Cornell Univ. Agr. Expt. Sta., 1897.

Exhibit: Cocoon, adult, work, and figure.

EYE-SPOTTED BUD-MOTH.

Tmetocera ocellana Schiff.

(Feeds on buds and young leaves.)

For general account see Slingerland, Bul. 50, Cornell Univ. Agr. Expt. Sta., 1893.

Exhibit: Pupa, adult, and work.

APPLE-TREE BUCCULATRIX.

Bucculatrix pomifoliella Clem.

For general account and partial bibliography see Slingerland and Fletcher, Bul. 214, Cornell Univ. Agr. Expt. Sta., pp. 69–78, figs., 1903.

Exhibit: Cocoon, adult, and figure.

THE RESPLENDENT SHIELD-BEARER.

Coptodisca splendoriferella Clem.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 263–265, 1899.

Exhibit: Cocoon, adult, work, and figure.

CHAPIN'S APPLE-LEAF SEWER.

Ancylis nubeculana Clem.

For brief article see Lugger, 4th Rpt. St. Ent. Minn., pp. 239–240, 1899.

Exhibit: Pupa, adult, work, and figure.

THE OBLIQUE-BANDED LEAF-ROLLER.

Archips rosaceana Harr.

(Formerly *Cacœcia.*)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 226–227, 1899.

Exhibit: Pupa, adult, and work.

THE LESSER APPLE LEAF-FOLDER.

Acleris minuta Rob.

(Formerly *Teras.*)

For general account see J. B. Smith, Farmers' Bul. 178, U. S. Dept. Agric., pp. 12–17, 1903.

Exhibit: Pupa and adult.

THE LEAF CRUMPLER.

Mineola indiginella Zell.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 211–213, 1899.

Exhibit: Cocoon, pupa, adult, and figure.

THE APPLE-LEAF SKELETONIZER.

Canarsia hammondi Riley.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 217–218, 1899.

Exhibit: Pupa, adult, and work.

APPLE-TREE TENT-CATERPILLAR.

Malacosoma americana Fab.

(Formerly *Clisiocampa.*)

For life history and bibliography see Felt, 14th Rpt. St. Ent. N. Y., pp. 177–190, 1898.

Exhibit: Eggs, larva, cocoon, pupa, adult and work, and the parasites; *Pimpla conquisitor* Say, and *Ichneumon lætus* Brullé.

THE LIME-TREE WINTER-MOTH.

Erannis tiliaria Harr.

(Formerly *Hibernia.*)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 193–195, 1899.

Exhibit: Pupa, adult, and figure.

THE ELM SPAN-WORM.

Ennomos subsignarius Hbn.

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 232–233, 306–307, 1890.

Exhibit: Eggs, larva, pupa, and work.

THE APPLE LEAF-MINER.

Tischeria malifoliella Clem.

For life history and bibliography see Lintner, 11th Rpt. N. Y. St. Ent., pp. 160–162, 1896.

Exhibit: Adult and work.

THE SPRING CANKER-WORM.

Paleacrita vernata Peck.

For general account see Coquillett, Cir. 9, Div. Ent., U. S. Dept. Agric., pp. 1–3, 1895.

Exhibit: Larva, adult, and figure.

THE FALL CANKER-WORM.

Alsophila pometaria Harr.

(Formerly *Anisopteryx.*)

For general account see Coquillett, Cir. 9, Div. Ent., U. S. Dept. Agric., pp. 3–4, 1895.

Exhibit: Eggs, larva, cocoon, adult, and figure.

THE WHITE-MARKED TUSSOCK-CATERPILLAR.

Hemerocampa leucostigma S. & A.

(Larvæ feed extensively upon fruit and shade trees and often damage shrubs and vines; see special case containing life history and parasites.)

For general account of this insect and its parasites see Howard, Tech. Ser., 5, Div. Ent., U. S. Dept. Agric., 1897; for life history, etc., Howard, Farmers' Bul. 99, pp. 12–20, 1899.

Exhibit: Egg-masses, larva, and adult.

THE FALL WEB-WORM.

Hyphantria cunea Dru.

For general account see Howard, Farmers' Bul. 99, U. S. Dept. Agric., pp. 20–25, 1899.

Exhibit: Larva, pupa, adult, and work.

THE COMMON BAGWORM.

Thyridopteryx ephemeræformis Steph.

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 258–262, 1890.

Exhibit: Cocoons and figure.

IO MOTH.

Automeris io Fab.

For general account see Lugger, 4th Rpt. State Ent. Minn., pp. 126–129, fig. 130, and pl. 16, fig. 129, 1899.

Exhibit: Adult.

THE BROWN-TAIL MOTH.

Euproctis chrysorrhœa Linn.

For life history and general article see Fernald and Kirkland, Spec. Bul. Hatch. Expt. Sta., Mass., 15 pp., 1 fig., 3 pls., 1898.

Exhibit: Larva, adult and figure.

THE GYPSY MOTH.

Porthetria dispar Linn.

For life history, habits and general account see Forbush and Fernald, "The Gypsy Moth," 495 pp. + i–c, 1896; Howard, Bul. 11, n. s., Div. Ent., U. S. Dept. Agric., 1897. (Formerly *Ocneria.*)

Exhibit: Larva, adult, and figure.

THE CLIMBING CUTWORM.

Euxoa scandens Riley.

(Formerly *Carneades.*)

For general account see Slingerland, Bul. 104, Cornell Univ. Agr. Expt. Sta., pp. 567–569, Pl. I, 1895.

Exhibit: Adult.

APPLE-TREE APHIS.

Aphis mali Fitch.

For general account see Smith, Bul. 143, N. J. Agr., Expt. Sta., 1900.

For general article treating of several species occurring on apple see Pergande, Bul. 44 Div. Ent., U. S. Dept. Agric., pp. 5–23, 1904.

Exhibit: Work and figure and the following enemies: *Adalia bipunctata* L., *Anatis 15-punctata* Ol., *Coccinella novemnotata* Hbst., *C. sanguinea* L., *Harmonia picta* Rand., *Hippodamia convergens* Guen., and *H. 13-punctata* L.

THE CECROPIA SILK MOTH.

Samia cecropia Linn.

For general account see Riley, 4th Rpt. Ins. Mo., pp. 103-111, 1872.

Exhibit: Larva, cocoon, and adult.

THE IMBRICATED SNOUT-BEETLE.

Epicærus imbricatus Say.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 28–29, 1903, and Bul. 19, n. s., pp. 62–67, 1899.

Exhibit: Adult.

SYNETA ALBIDA Lec.

For brief notice see Riley and Howard, Insect Life, v. IV, p. 396, 1892.

Exhibit: Adult and work.

RED-LEGGED FLEA-BEETLE.

Crepidodera rufipes Linn.

For general article see Insect Life, v. V, pp. 334–342, 1893.

Exhibt: Adult.

THE APPLE-LEAF FLEA-WEEVIL.

Orchestes pallicornis Say.

For short account of life history see Forbes, Trans. Ill. St. Hort. Soc., f. 1901, p. 147, 1902.

Exhibit: Adult.

INJURING THE FRUIT.

TEN-SPOTTED XANTHONIA.

Xanthonia decemnotata Say.

Exhibit: Adult and work.

THE INDIAN EUPHORIA.

Euphoria inda Linn.

For life history and general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 67–74, 1899.

Exhibit: Adult and work.

JUNE BEETLE; FIG EATER.

Allorhina nitida Linn.

For general account see Howard, Bul. 10, n. s., Div. Ent., U. S Dept. Agric., pp. 20-26, 1898.

Exhibit: Adult.

CODLING MOTH; APPLE WORM.

Carpocapsa pomonella Linn.

For full bibliography, life history, and illustrations see Simpson, Bul. 41, Div. Ent., U. S. Dept. Agric., 105 pp., 1903, figs.

Exhibit: Full life history (larva, pupa, cocoons, and adult) and parasites: *Pimpla annulipes* and *P. conquisitor.* Enemies: *Chauliognathus pennsylvanicus* and *Telephorus bilineatus.*

THE GREEN FRUIT-WORMS.

The three following species of *Xylina* are commonly known as green fruit-worms.

For general account see Slingerland, Bul. 123, Cornell Univ. Agr. Expt. Sta., 1896.

Xylina antennata Walk.

Exhibit: Adult and figure.

Xylina grotei Riley.

Exhibit: Adult and figure.

Xylina laticinerea Grote.

Exhibit: Adult and figure.

ILLUSTRATION SHOWING WORK OF A TORTRICID ON APPLE.

(The larva mines in and feeds beneath the skin of the fruit.)

THE PLUM CURCULIO.

Conotrachelus nenuphar Hbst.

For general account and bibliography see Lintner, 7th Rpt. N. Y. St. Ent., pp. 288–296, 1891.

Exhibit: Adult and figure.

THE APPLE CURCULIO.

Anthonomus quadrigibbus Say.

For general account see Gillette, Bul. 11, Iowa Agric. Expt. Sta., pp. 492–494, 1890.

Exhibit: Adult and figure.

THE APPLE-FRUIT MAGGOT.

Rhagoletis pomonella Walsh.

(Formerly *Trypeta.*)

For life history see Harvey, Rpt. Maine Agr. Expt. Sta., p. 190, 1889; Banks, Bul. 34, Div. Ent., U. S. Dept. Agric., p. 45, 1902.

Exhibit: Puparium, adult, and figure.

THE PERIODICAL CICADA.

THE PERIODICAL CICADA.

Tibicen septendecim Linn.

(Injures by deposition of eggs in the twigs almost all fruit, shade, and forest trees. Formerly *Cicada.*)

For life history and general article see Marlatt, Bul. 14, n. s., Div. Ent., U. S. Dept. Agric. 1898.

Exhibit: Full life history with figures. Enemies: *Megastizus speciosus* Dru. (adult and figure), *Oripoda elongata* (figure), *Pediculoides ventricosus* (figure).

WHITE-MARKED TUSSOCK CATERPILLAR AND PARASITES.

For general account of this insect and the parasites affecting it see Howard, Tech. series, 5, Div. Ent., U. S. Dept. Agric., 1897. For life history, etc., see Howard, Farmers' Bul. 99, U. S. Dept. Agric., pp. 12–20, 1899.

THE WHITE-MARKED TUSSOCK-CATERPILLAR.

Hemerocampa leucostigma S. & A.

(Larvæ feed extensively upon fruit and shade trees and often damage shrubs and vines.)

Exhibit: Egg masses, larva, pupa, cocoon, adult, figure, and the following parasites:

Primary Hymenopterous Parasites.

Pimpla conquisitor Say.

Exhibit: Adult, cocoon, and figure.

Pimpla annulipes Say.

Exhibit: Adult.

Pimpla inquisitor Say.

Exhibit: Adult, cocoon, and figure.

Apanteles hyphantriæ Riley.

Exhibit: Adult and cocoon.

Meteorus communis Cress.

Exhibit: Adult and cocoon.

Limneria valida Cress.

Exhibit: Adult and cocoon.

Chalcis ovata Say.

Exhibit: Adult.

Secondary Hymenopterous Parasites.

Dibrachys boucheanus Ratz.

(Parasitic on *Pimpla*, *Meteorus*, etc.)
Exhibit: Adult and figure.

Chalcis debilis Say.

(Parasite on *Pimpla*, *Meteorus*, etc.)
Exhibit: Adult and cocoon.

Tertiary Hymenopterous Parasites.

Asecodes albitarsis Ashm.

(Parasite on *Dibrachys.*)
Exhibit: Adult and figure.

Primary Dipterous Parasites.

Tachina mella Walk.

Exhibit: Adult.

Frontina aletiæ Riley.

Exhibit: Adult.

INSECTS INJURIOUS TO PEACH.

Saunders, Insects Injurious to Fruit, 2d edit., pp. 191–200, 1900.

THE NATIVE PEACH BARK-BEETLE.

Phlœophthorus liminaris Harr.

(Formerly *Phlæotribus.*)

For general account see Lintner, 9th Rpt. N. Y. St. Ent., pp. 365–368, 1893.

Exhibit: Adult and work.

THE FRUIT-TREE BARK-BEETLE.

Scolytus rugulosus Ratz.

For general account see Chittenden, Cir. 29, Div. Ent., U. S. Dept Agric., 1898.

Exhibit: Adult, work, figure, and the parasite *Chiropachys colon.*

THE PEACH-TREE BORER.

Sanninoidea exitiosa Say.

(Formerly *Sannina.*)

For general account see Marlatt, Cir. 17, Div. Ent., U. S. Dept. Agric., 1896.

Exhibit: Pupa, cocoon, adult, and figure.

THE PERIODICAL CICADA.

Tibicen septendecim Linn.

(Injures by deposition of eggs in the twigs almost all fruit, shade, and forest trees. See special case containing stages and illustrations.)

For life history and general article see Marlatt, Bul. 14, n. s., Div. Ent., U. S. Dept. Agric., 1898.

Exhibit: Pupa, adult, and enemy *Megastizus speciosus.*

THE BLUE-SPANGLED PEACH-MOTH.

Haploa lecontei Boisd.

(Formerly *Callimorpha.*)

For general account see Saunders, Insects Injurious to Fruit, 2d edit., pp. 197–199, 1900.

Exhibit: Adult.

THE PEACH-TWIG MOTH.

Anarsia lineatella Zell.

For general article with bibliography see Marlatt, Bul. 10, n. s., Div. Ent., U. S. Dept. Agric., pp. 7–20, 1898.

Exhibit: Pupa, adult, work, and figure.

THE INDIAN FRUIT-FLY.

Ceratitis capitata Wied.

For general article see Riley, Rpt. U. S. Dept. Agric., 1890, pp. 255–257.

Exhibit: Pupa, adult, and figure.

THE PEACH SCALE.

Eulecanium persicæ Fabr.

(Food plants: Peach, plum, quince, etc.; formerly a Lecanium. See under "More important scale insects.")

For bibliography, food plants, and distribution see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 191–193, 1903.

Exhibit: Infested twig.

PUTNAM SCALE; CRANBERRY SCALE.

Aspidiotus ancylus Putn.

(Food plants: Apple, apricot, box-elder, cottonwood, cranberry, elm, hemlock, maple, oak, peach, pear, plum, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 252–253, 1903.

Exhibit: Infested twig.

THE SAN JOSE SCALE.

Aspidiotus perniciosus Comst.

(Food plants: Almond, apple, apricot, birch, black walnut, black currant, catalpa, chestnut, crab-apple, crab-grass, cherry, grape, hickory, oak, peach, pear, persimmon, plum, poplar, prune, Rocky Mountain cherry, rose, silver maple, willow, and many other plants. See under "More important scale insects."

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 271–275, 1903; Howard and Marlatt, Bul. 3, n. s., Div. Ent., U. S. Dept. Agric., 1896, 80 pp.

Exhibit: Infested twig.

THE CHERRY LEAF-BEETLE.

Galerucella cavicollis Lec.

For general article and distribution see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 90–93, 1899.

Exhibit: Adult.

THE CHERRY-FRUIT MAGGOT.

Rhagoletis cingulata Loew.

For detailed account see Slingerland, Bul. 172, Cornell Univ. Agr. Exp. Sta., 41 pp., 6 figs., 1899; Chittenden, Bul. 44, Div. Ent., U. S. Dept. Agric., p. 70–75, 1904.

Exhibit: Adult.

INSECTS INJURIOUS TO PEAR.

(Many of the insects injuring the apple will be found attacking the pear.)

THE FRUIT-TREE BARK-BEETLE.

Scolytus rugulosus Ratz.

For general account see Chittenden, Cir. 29, Div. Ent., U. S. Dept. Agric., 1898.

Exhibit: Adult, work, and figure.

PEAR-BLIGHT BEETLE; SHOT-BORER.

Xyleborus pyri Peck.

(Formerly *X. dispar.*)

For general account see Hubbard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 22–23, 1897.

Exhibit: Adult, work, and figure.

THE PEAR BLISTER MITE.

Eriophyes pyri Pagenst.

For detailed account see Slingerland, Bul. 61, Cornell Univ. Agr. Exp. Sta., pp. 317–328, figs., 1893.

Exhibit: Work and figure.

THE PEAR PSYLLA.

Psylla pyri Linn.

For general accounts see Slingerland, Bul. 44, Cornell Univ. Agr. Sta., 1892; Marlatt, Cir. 7, Div. Ent., U. S. Dept. Agric., 1895.

Exhibit: Adult and figure.

THE PEAR SLUG.

Eriocampoides limacina Ratz.

(Formerly *Eriocampa cerasi.*)

For general account see Marlatt, Cir. 28, Div. Ent., U. S. Dept. Agric., 1897.

Exhibit: Adult, work, and figure.

THE SCURFY BARK-LOUSE.

Chionaspis furfura Fitch.

(Food-plants: Apple, cherry, currant, elm, pear, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 217-219, 1903; Howard, Yearbook, U. S. Dept. Agric., 1894, pp. 259–261, figs.; Banks, Bul. 34, Div., Ent., U. S. Dept. Agric., p. 14, 1902.

Exhibit: Infested twig.

SINUATE PEAR-BORER.

Agrilus sinuatus Oliv.

For general accounts see Smith, Rpt. Entom. N. J. Agr. Exp. Sta. f. 1894, pp. 556–561, 1895; Banks, Bul. 34, Div. Ent., U. S. Dept. Agric., pp. 40–41, 1902.

Exhibit: Adult and figure.

INSECTS INJURIOUS TO PLUM.

THE PLUM CURCULIO.

Conotrachelus nenuphar Hbst.

For general account and bibliography see Lintner, 7th Rpt. N. Y. St. Ent., pp. 288–296, 1891.

Exhibit: Adult, figure, and enemies, *Aspidoglossa subangulata*, *Chauliognathus pennsylvanicus*, *Harpalus caliginosus*, and parasite *Sigalphus curculionis*.

THE PLUM GOUGER.

Anthonomus prunicida Walsh.

(Formerly *Coccotorus.*)

For general accounts see Riley and Howard, Insect Life, v. II, pp. 258–259, 1890; Gillette, Bul. 47, Colo. Agr. Exp. Sta., pp. 20–22, 1898.

Exhibit: Adult, work, and figure.

THE HOP PLANT-LOUSE.

Phorodon humuli Schr.

(Attacks hop and plum.)

For full life history see Riley, Cir. 2, Div. Ent., U. S. Dept. Agric., 1891.

Exhibit: Adult and work.

FORBES' SCALE; CHERRY SCALE.

Aspidiotus forbesi Johns.

(See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 259–260, 1903.

Exhibit: Infested twig.

INSECTS LIABLE TO BE DISTRIBUTED ON NURSERY STOCK.

See Banks, Bul. 34, Div. Ent., U. S. Dept. Agric., 46 pp., 1902.

THE PEACH SCALE.

Eulecanium persicæ Fab.

(Food plants: Peach, plum, quince, etc.; formerly *Lecanium*. See under "More important scale insects.")

For bibliography, food plants, and distribution see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 191–193, 1903.

Exhibit: Infested twig.

OYSTER-SHELL BARK-LOUSE.

Lepidosaphes ulmi Linn.

(Attacks principally apple, currant, Cornus, cottonwood, lilac, pear, sassafras, etc.; formerly *Mytilaspis pomorum* Bouché. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 314–317, 1903.

Exhibit: Infested twig.

THE SCURFY BARK-LOUSE.

Chionaspis furfura Fitch.

(Food plants: Apple, cherry, currant, elm, pear, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 217–219, 1903; Howard, Yearbook, U. S. Dept. Agric., 1894, pp. 259–261, fig.

Exhibit: Infested twig.

THE SAN JOSE SCALE.

Aspidiotus perniciosus Comst.

(Food-plants: Almond, apple, apricot, birch, black walnut, black currant, catalpa, chestnut, crab-apple, crab-grass, cherry, grape, hickory, oak, peach, pear, persimmon, plum, poplar, prune, Rocky Mountain cherry, rose, silver maple, willow, and many other plants. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 271–275, 1903; Howard and Marlatt, Bul. 3, n. s., Div. Ent., U. S. Dept. Agric., 1896. 80 pp.

Exhibit: Infested twig.

PUTNAM SCALE; CRANBERRY SCALE.

Aspidiotus ancylus Putn.

(Food-plants: Apple, apricot, box-elder, cottonwood, cranberry, elm, hemlock, maple, oak, peach, pear, plum, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 252–253, 1903.

Exhibit: Infested twig.

THE CHERRY SCALE; FORBES' SCALE.

Aspidiotus forbesi Johns.

(Food-plants: Apple, cherry, currant, honey locust, peach, pear plum, walnut, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 259–260, 1903.

Exhibit: Infested twig.

THE WALNUT SCALE.

Aspidiotus juglans-regiæ Comst.

(Food-plants: Ash, cherry, crab-apple, currant, English walnut, locust, peach, pear, prune, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 265, 1903.

EXHIBIT: Infested twig.

THE GREEDY SCALE.

Aspidiotus rapax Comst.

(Food-plants: Cottonwood, maple, olive, pear, quince, apple, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 276–278, 1903.

EXHIBIT: Infested twig.

THE EUROPEAN FRUIT SCALE.

Aspidiotus ostreæformis Curt.

(Food-plants: Apple, cherry, maple, oak, peach, pear, etc. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 268–270, 1903.

EXHIBIT: Infested twig.

THE WEST INDIAN PEACH SCALE.

Diaspis pentagona Targ.

(Formerly *D. lanatus*. See under "More important scale insects.")

For bibliography and partial list of food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 234–235, 1903; Riley and Howard, Insect Life, v. VI, pp. 287–295, figs., 1894.

EXHIBIT: Infested twig.

THE ROSE SCALE.

Aulacaspis rosæ Bouché.

(Food-plants: Blackberry, mango, myrtle, pear, raspberry, rose, Cycas, Ailanthus, etc. See under "More important scale insects.")

For bibliography see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 236, 1903.

EXHIBIT: Infested twig.

THE WOOLLY APPLE APHIS.

Schizoneura lanigera Hausm.

For general account see Marlatt, Cir. 20, Div. Ent., U. S. Dept. Agric., 1897.

EXHIBIT: Infested roots, twigs, and figure.

THE BLACK PEACH APHIS.

Aphis persicæ-niger Sm.

Original description E. F. Smith, Ent. Amer., pp. 101–103, 1890.

For general account see Slingerland, Bul. 49, Cornell Univ. Agr. Expt. Sta., pp. 427–433, figs. 1892.

EXHIBIT: Figure.

APPLE-TREE APHIS.

Aphis mali Fitch.

For general account separating species occurring on apple see Pergande, Bul. 44, Div. Ent., U. S. Dept. Agric., pp. 5–23, 1904.

For general account see Smith, Bul. 14, N. J. Agr. Expt. Sta., 1900.

EXHIBIT: Figure.

THE BUFFALO TREE-HOPPER.

Ceresa bubalus Say.

For general account see Marlatt, Cir. 23, Div. Ent., U. S. Dept. Agric., 1897.

EXHIBIT: Adult and figure.

APPLE-TREE TENT-CATERPILLAR.

Malacosoma americana Fab.

(Formerly *Clisiocampa.*)

For life history and bibliography see Felt, 14th Rpt. N. Y. St. Ent., pp. 177–190, 1898.

EXHIBIT: Adult and figure.

THE FALL WEB-WORM.

Hyphantria cunea Dru.

For general account see Howard, Farmers' Bul. 99, U. S. Dept. Agric., pp. 20–25, 1899.

EXHIBIT: Adult.

THE BROWN-TAIL MOTH.

Euproctis chrysorrhœa Linn.

For life history and general article see Fernald and Kirkland, Spec. Bul. Hatch Expt. Sta., Mass., pp. 15, 1 fig., 3 pls., 1898.

EXHIBIT: Larva and adult.

THE WHITE-MARKED TUSSOCK-CATERPILLAR.

Hemerocampa leucostigma S. & A.

(Larvæ feed extensively upon fruit and shade trees, and often damage shrubs and vines; see special case containing life history and parasites.)

For general account of this insect and its parasites see Howard Tech. ser., 5, Div. Ent., U. S. Dept. Agric., 1897; for life history, Howard, Farmers' Bul. 99, pp. 12–20, 1899.

EXHIBIT: Larva and adult.

THE LEAF CRUMPLER.

Mineola indiginella Zell.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 211–213, 1899.

Exhibit: Larva and adult.

THE GYPSY MOTH.

Porthetria dispar Linn.

For life history, habits, and general account see Forbush and Fernald, The Gypsy Moth, pp. 495+i–c, 1896. (Formerly *Ocneria.*)

Exhibit: Larva, adult, and figure.

THE SPRING CANKER-WORM.

Paleacrita vernata Peck.

For general account see Coquillett, Cir. 9, Div. Ent., U. S. Dept. Agric., pp. 1–3, 1895.

Exhibit: Adult and figure.

THE FALL CANKER-WORM.

Alsophila pometaria Harr.

(Formerly *Anisopteryx.*)

For general account see Coquillett, Cir. 9, Div. Ent., U. S. Dept. Agric., pp. 3–4, 1895.

Exhibit: Eggs, adult, and figure.

THE PEACH-TREE BORER.

Sanninoidea exitiosa Say.

(Formerly *Sannina.*)

For general account see Marlatt, Cir. 17, Div. Ent., U. S. Dept. Agric., 1896.

Exhibit: Adult and figure.

THE PEACH-TWIG MOTH.

Anarsia lineatella Zell.

For general article with bibliography see Marlatt, Bul. 10, n. s., Div. Ent., U. S. Dept. Agric., pp. 7–20, 1898.

Exhibit: Adult.

EYE-SPOTTED BUD-MOTH.

Tmetocera ocellana Schiff.

(Feeds on buds and young leaves.)

For general account see Slingerland, Bul. 50, Cornell Univ. Agric. Expt. Sta., 1893.

Exhibit: Adult and figure.

THE COMMON BAGWORM.

Thyridopteryx ephemeræformis Steph.

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 258–262, 1890.

Exhibit: Adult, cocoon, and figure.

THE APPLE-TWIG BORER.

Amphicerus bicaudatus Say.

For general account see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 11–13, figure, 1898.

Exhibit: Adult and figure.

ROUND-HEADED APPLE-TREE BORER.

Saperda candida Fab.

For general account see Chittenden, Cir. 32, Div. Ent., U. S. Dept. Agric., pp. 1–8, 1898.

Exhibit: Adult and figure.

FLAT-HEADED APPLE-TREE BORER.

Chrysobothris femorata Fab.

For general account see Chittenden, Cir. 32, Div. Ent., U. S. Dept. Agric., pp. 9–12, 1898.

Exhibit: Adult and figure.

FRUIT-TREE BARK BEETLE; SHOT-HOLE BORER.

Scolytus rugulosus Ratz.

For general account see Chittenden, Cir. 29, Div. Ent., U. S. Dept. Agric., 1898.

Exhibit: Adult and figure.

THE PEAR PSYLLA.

Psylla pyri Linn.

For general accounts see Slingerland, Bul. 44, Cornell Univ. Agr. Expt. Sta., 1892; Marlatt, Cir. 7, Div. Ent., U. S. Dept. Agric., 1895.

Exhibit: Figure.

THE PEAR BLISTER MITE.

Eriophyes pyri Pagenst.

For detailed account see Slingerland, Bul. 61, Cornell Univ. Agr. Expt. Sta., pp. 317–328, figures, 1893.

Exhibit: Work and figure.

INSECTS INJURIOUS TO GRAPE.

For the more important grape insects see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., 1898; Saunders, Insects Injurious to Fruit, 2d edition, pp. 227–302, 1900; Bruner, Nebr. State Hortic. Soc. Rept. f. 1895, pp. 69–162, 1896.

INJURING THE ROOTS.

THE TILE-HORNED PRIONUS.

Prionus imbricornis Linn.

For general account of *Prionus* species see Lugger, 5th Rpt. St. Ent. Minn., pp. 110–111, 1899.

Exhibit: Adult.

THE GRAPEVINE ROOT-BORER.

Memythrus polistiformis Harr.

(Formerly *Sciapteron.*)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 55–57, 1899.

EXHIBIT: Figures.

INJURING LEAVES AND ROOTS.

GRAPE PHYLLOXERA.

Phylloxera vastatrix Planch.

For general article see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 4–9, figs., 1898.

EXHIBIT: Work and figure.

INJURING THE STEMS AND BRANCHES.

COTTONY MAPLE SCALE.

Pulvinaria innumerablis Rathv.

(Foot-plants: Alder, apple, box-elder, elm, grape, linden, maples, pear, willow, etc. See under "More Important Scale Insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 134–135, 1903; Howard, Bul. 22, n. s., Div. Ent., U. S. Dept. Agric., pp. 8–16, figs. 4, 1900.

EXHIBIT: Infested twig.

THE GRAPE SCALE.

Aspidiotus uvæ Comst.

(Food-plants: Ampelopsis, grape, hickory.)

For bibliography see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 280, 1903.

EXHIBIT: Infested twig.

THE APPLE TWIG-BORER.

Amphicerus bicaudatus Say.

For general account see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 11–13, figure, 1898.

EXHIBIT: Adult and figure.

RED-SHOULDERED TWIG-BORER.

Sinoxylon basilare Say.

For general account see Lugger, 5th Rpt. St. Ent. Minn., pp. 70–72, 1899.

EXHIBIT: Adult and figure.

THE SNOWY TREE-CRICKET.

Œcanthus niveus DeG.

For general account see Lugger, 3d Rpt. St. Ent. Minn., pp. 269–271, 1898.

EXHIBIT: Adult and figure.

ŒCANTHUS LATIPENNIS Riley.

For brief article see Lugger, 3d Rpt. St. Ent. Minn., p. 273, 1898.

EXHIBIT: Adult.

GRAPE-VINE ROOT-WORM.

Fidia viticida Walsh.

For life history and bibliography see Felt, Bul. 72, N. Y. St. Museum, 1903, 55 pp., with colored plate.

EXHIBIT: Adult and figure.

GRAPE-VINE FIDIA.

Fidia longipes Mels.

EXHIBIT: Adult.

INJURING THE LEAVES.

ACHEMON SPHINX.

Pholus achemon Dru.

(Formerly *Philampelus.*)

For general account see Lugger, 4th Rpt. State Ent. Minn., pp. 38–40, 1899.

EXHIBIT: Larva and adult.

GRAPE-VINE HOG-CATERPILLAR.

Ampelophaga myron Cram.

For general account see Lugger, 4th Rpt. State Ent. Minn., pp. 42–45, 1899.

EXHIBIT: Larva and adult.

ABBOT'S SPHINX.

Sphecodina abbotii Swaine.

(Formerly *Thyreus.*)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 32–33, 1899.

EXHIBIT: Larva and adult.

LARGE BEAUTIFUL WOOD NYMPH.

Euthisanotia grata Fabr.

(Formerly *Eudryas.*)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 69–71, 1899.

EXHIBIT: Larva and adult.

SMALL BEAUTIFUL WOOD NYMPH.

Euthisanotia unio Hübn.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 71–72, 1899.

EXHIBIT: Larva and adult.

EIGHT-SPOTTED FORESTER.

Alypia octomaculata Fab.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 66–67, 1899.

Exhibit: Larva and adult.

SOCIAL GRAPE CATERPILLAR.

Harrisina americana Guer.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 72–74, 1899. (Formerly *Procris.*)

Exhibit: Adult and figure.

GRAPE LEAF-FOLDER.

Desmia funeralis Hübn.

For general account see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 16–17, 1898.

Exhibit: Larva, adult, and work.

GRAPE-VINE PLUME-MOTH.

Oxyptilus periscelidactylus Fitch.

For general article see Lugger, 4th Rpt. St. Ent. Minn., pp. 221–222, 1899; for bibliography and article see Lintner, 12th Rpt. St. Ent. N. Y., pp. 218–222, 1897.

Exhibit: Larva and adult.

GRAPE-VINE SAWFLY.

Blennocampa pygmaea Say.

For general articles see Harris, Insects Injurious to Vegetation, pp. 522–525; Beach, Lowe and Stewart, Bul. 170, N. Y. Agric. Expt. Sta., p. 417, 1899.

Exhibit: Adult and figure.

GRAPE-VINE FLEA-BEETLE.

Haltica chalybea Illig.

For general articles see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 13–14, 1898; Slingerland, Bul. 157, Cornell Univ. Agr. Expt. Sta. N. Y., 1898. For additional food plants see Lugger, 5th Rpt. St. Ent. Minn., pp. 157–159, 1899.

Exhibit: Adult and figure.

THE GRAPE-VINE COLASPIS.

Colaspis brunnea Fab.

For general article see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 13–14, 1903.

Exhibit: Adult.

THE VARIED ANOMALA.

Anomala varians Burm.

Exhibit: Adult.

THE GRAPE-VINE LEAF-HOPPER.

Typhlocyba comes Say.

For general article see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 18–20, 1898, under *Typhlocyba vitifex.* For full life history and general account see Slingerland, Bul. 215, Cornell Univ. Agr. Expt. Sta., 1904.

EXHIBIT: Adult and figure.

THE WAVED SHARP-SHOOTER.

Oncometopia undata Fab.

(Formerly *Proconia.*)

For general article see Lugger, 6th Rpt. St. Ent. Minn., pp. 136–137, 1900.

EXHIBIT: Adult.

INJURING THE FRUIT.

THE GRAPE-SEED WORM.

Isosoma vitis Saunders.

For general account see Saunders, Insects Injurious to Fruits, 2d ed., pp. 296–297, 1900.

EXHIBIT: Adult.

THE GRAPE FRUIT-MOTH.

Polychrosis botrana Schiff.

(Formerly *Eudemis.*)

For general article see Marlatt, Farmers' Bul. 70, U. S. Dept. Agric., pp. 20–22, 1898.

EXHIBIT: Adult and figure.

THE GRAPE SEED-WEEVIL.

Craponius inæqualis Say.

For general accounts see Saunders, Insects Injurious to Fruits, 2d ed., pp. 300–301, 1900; Lintner, 9th Rpt. N. Y. St. Ent., pp. 364–365, 1893.

EXHIBIT: Adult and figure.

INSECTS INJURIOUS TO COTTON.

For general articles on cotton insects see Howard, The Cotton Plant, Bul. 33, Office Expt. Sta., U. S. Dept. Agric., pp. 317–350, 1896; Farmers' Bul. 47, U. S. Dept. Agric., 1897; Ashmead, Insect Life, v. VII, pp. 25–29, 240–247, 1894, and pp. 320–326, 1895.

NOTABLY INJURIOUS.

COTTON BOLLWORM; CORN-EAR WORM.

Heliothis obscura Fab.

(Formerly *H. armiger.* Larvæ feed on bolls of cotton, ears of corn, tobacco buds, beans, and in tomatoes; also cut off young plants of various garden crops.)

For full life history and general account see Quaintance, Farmers' Bul. 191, U. S. Dept. Agric., 1904.

Exhibit: Larva, pupa, adult, work in cotton bolls, and illustrations of different stages, and work on various plants. Parasite exhibited: *Archytas piliventris;* adult, pupa, and figure. Enemies exhibited: *Calosoma lugubre*, *C. Sayi*, *C. scrutator* Fab., *Polistes annularis*, and *P. rubiginosus* Lep.

MEXICAN COTTON BOLL WEEVIL.

Anthonomus grandis Boh.

(Breeds in and destroys bolls.)

For full life history and general account see Hunter and Hinds, Bul. 45, Div. Ent., U. S. Dept. Agric., 1904; also Hunter, Farmers' Bul. 189, 1904.

Exhibit: Life history (larvæ, pupæ, adults, injured cotton bolls, with stages present in bolls, and uninjured bolls); illustrations and map showing distribution in United States.

THE COTTON WORM.

Alabama argillacea Hübn.

(Formerly *Aletia xylina.* Larvæ feed on the leaves.)

For life history and general account see Howard, The Cotton Plant, Bul. 33, Office Expt. Stations, U. S. Dept. Agric., pp. 320–328, 1896.

Exhibit: Larva, pupa, cocoon, adult, and figure.

RED BUG; COTTON-STAINER.

Dysdercus suturellus H.-Schf.

(Punctures boll and seeds, aborting them and staining fibers an indelible red or yellow color.)

Exhibit: Nymph, adult, work, and figure.

GLASSY-WINGED SHARPSHOOTER.

Homalodisca coagulata Say.

(Punctures stalk, leaves, and flowers; oviposits in forms and squares; very abundant.

Exhibit: Nymph, adult, and figure.

COTTON APHIS.

Aphis gossypii Glover.

(Punctures leaves and young bolls; late in season causes falling of young bolls.)

See Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 58–61, 1903.

Exhibit: Adult, work, and figure.

LEAF-CUTTING ANT.

Atta fervens Say.

(Cleans up plants, cotton worms, and pupæ.)

Exhibit: Adult.

THE AMERICAN LOCUST.

Schistocerca americana Dru.

For life history and general account see Howard, Insect Life, v. VII, pp. 220–229, 1894; Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., p. 27, 1901.

Exhibit: Nymph and adult.

THECLA PŒAS Hubn.

(Larvæ feed on or bore into bolls, and also feed on leaves.)

For brief account see Mally, Bul. 29, Div. Ent., Dept. Agric., pp. 29–30, 1893.

Exhibit: Adult and work.

COTTON SNOUT-MOTH.

Platynota sentana Clem.

(Attacks forms and squares; afterwards feeds on leaves.)

Exhibit: Adult.

RASPBERRY SNOUT-MOTH.

Platynota rostrana Walk.

(Larvæ bore into young bolls.)

Exhibit: Adult.

COTTON-BOLL CUTWORM.

Prodenia ornithogalli Guen.

(Works as the boll-worm; feeds on bolls and squares.)

For life history, general account, and distribution see Chittenden, Bul. 27, n. s., Div. Ent. U. S. Dept. Agric., pp. 64–71, 1901.

Exhibit: Adult.

SHAGREENED CUTWORM.

Feltia malefida Guen.

(Larvæ destroy young plants.)

Exhibit: Adult.

OCCASIONALLY INJURIOUS.

THICK-THIGHED WALKING-STICK.

Diapheromera femorata Linn.

For general account of life history see Howard, The Insect Book, pp. 323–325; fig. 214; pl. 32, fig. 13, 1901.

Exhibit: Adult.

LEAF-PALPUS CRICKET.

Phyllopalpus pulchellus Uhl.

(Feeds on petals, corolla, and pollen.)

Exhibit: Adult.

AGITATING CRICKET.

Hapithus agitator Uhl.

Exhibit: Adult.

BANDED CRICKET.

Nemobius fasciatus DeG.

Exhibit: Adult.

TETTIGIDEA LATERALIS Say.

Exhibit: Adult.

CONE-HEADED LOCUST.

Conocephalus obtusus Burm.

(Feeds on leaves, eating large pieces out of side and gnawing holes through the middle.)

Exhibit: Adult.

OBSCURE GRASSHOPPER.

Schistocerca obscura Burm.

(Feeds upon leaves, and sometimes almost defoliates branches.)

For brief notices see Ashmead, Insect Life, v. VII, p. 26, 1894; Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., pp. 27–28, 1901.

Exhibit: Adult. (Formerly *Acridium*.)

THREE-SPOTTED SOLDIER-BUG.

Euschistus tristigmus Say.

(Common in cotton; punctures terminal shoots.)

Exhibit: Adult.

CHARIESTERUS ANTENNATOR Fab.

(Feeds on juices of cotton plants.)

Exhibit: Adult.

SOUTHERN LEAF-FOOTED PLANT-BUG.

Leptoglossus phyllopus Linn.

(Punctures buds and young bolls.)

For life history and general account see Chittenden, Bul. 19, n. s., Div. Ent. U. S. Dept. Agric., pp. 46–48, 1899.

Exhibit: Adult.

METAPODIUS FEMORATUS Fab.

(Attacks cotton worms and also punctures young bolls.)

Exhibit: Adult.

CALOCORIS RAPIDUS Say.

(Punctures buds and young bolls; causes bolls to "flare" and drop.)

Exhibit: Adult.

AULACIZES IRRORATA Fab.

(Common; feeding on stalk, etc.)

Exhibit: Adult.

SIX-SPOTTED TREE-HOPPER.

Cicadula sexnotata Fall.

(Feeds on cotton stalks, etc.)

Exhibit: Adult.

SCOLOPS SULCIPES Say.

(Punctures stems.)

Exhibit: Adult.

ENTILIA SINUATA Fab.

(Punctures terminal shoots.)

For general account see Howard, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., pp. 75–78, 1901.

Exhibit: Adult.

THE PHYLLIRA TIGER-MOTH.

Apantesis phyllira Dru.

(Sometimes locally almost as injurious as the cotton worm.)

Exhibit: Adult.

GREAT LEOPARD MOTH.

Ecpantheria deflorata Fab.

(Formerly *E. scribonia* Stäl.)

Exhibit: Adult.

ABBOT'S BAGWORM.

Oiketicus abbottii Grote.

Exhibit: Adult.

SALT-MARSH CATERPILLAR.

Estigmene acræa Dru.

(Formerly *Leucarctia.*)

For short account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 43–44, fig. 41, 1903.

Exhibit: Adult.

YELLOW-BEAR CATERPILLAR.

Diacrisia virginica Fab.

For general account see Lugger, 4th Rpt. State Ent. Minn., pp. 79–81, fig. 78, 1899.

Exhibit: Adult.

IO MOTH.

Automeris io Fab.

For general account see Lugger, 4th Rpt. State Ent. Minn., pp. 126–129, fig. 130, and pl. 16, fig. 129, 1899.

Exhibit: Adult.

MARGINED LEAF-CHAFER.

Anomala marginata Fab.

For bibliography and general account see Lintner, 10th Rpt. State Ent. N. Y., pp. 411–413, 1895.

Exhibit: Adult.

MELANCHOLY SAPCHAFER

Euphoria melancholica Gory.

(Frequents flowers for nectar and sap; exceptionally eats into bolls.)

Exhibit: Adult.

THE LIVID WIREWORM.

Monocrepidius lividus DeG.

(Feeds on leaves, blossoms, and squares.)

EXHIBIT: Adult.

LEMA SEX-PUNCTATA Ol.

(Adult feeds on leaves.)

For notice of occurrence on cotton see Ashmead, Insect Life, v. VII, p. 247, 1894.

EXHIBIT: Adult.

THE SOUTHERN CORN LEAF-BEETLE.

Myochrous denticollis Say.

For general account see Webster, Bul. 26, n. s., Div. Ent., U. S. Dept. Agric., p. 87, 1900.

EXHIBIT: Adult.

CRYPTOCEPHALUS CALIDUS Suff.

For notice of occurrence on cotton see Ashmead, Insect Life, v. VII, p. 247, 1894.

EXHIBIT: Adult.

TYPOPHORUS VIRIDICYANEUS Crotch.

(Beetle feeds on young leaves.)

EXHIBIT: Adult.

NODONOTA TRISTIS Ol.

(Gnaws bolls, causing them to drop.)

For list of food-plants see Chittenden, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., p. 61, 1897; for general article see Lugger, 5th Rept. State Ent. Minn., p. 146, 1899.

EXHIBIT: Adult.

ELONGATE FLEA-BEETLE.

Systena elongata Fab.

(On bolls.)

For notice of occurrence on cotton see Ashmead, Insect Life, v. VII, p. 247, 1894.

EXHIBIT: Adult.

THE EGG-PLANT FLEA-BEETLE.

Epitrix fuscula Cr.

For general account see Chittenden, Bul. 19, n. s., Div. Ent., U .S. Dept. Agric., pp. 87–89, 1899.

EXHIBIT: Adult.

BENEFICIAL INSECTS COLLECTED ON COTTON.

For general list of beneficial insects taken on cotton see Ashmead, Insect Life, v. VII, 1895.

CHRYSOPA ATTENUATA Walk.

EXHIBIT: Adult.

PERITHEMIS DOMITIA Dru.

Exhibit: Adult.

CAROLINA REAR HORSE.

Stagmomantis carolina Burm.

Exhibit: Egg mass and adult.

SINEA DIADEMA Fab.

(Attacks cotton worms and is destructive to other small caterpillars and aphides.)

Exhibit: Adult.

WHEEL-BUG.

Arilus cristatus Linn.

(Observed to prey on the cotton worm. Formerly *Prionidus*.)

Exhibit: Adult.

ZELUS BILOBUS Say.

(Attacks cotton worm.)

Exhibit: Nymph and adult.

APIOMERUS CRASSIPES Fab.

(Observed to attack cotton worms.)

Exhibit: Adult.

PHYMATA FASCIATA Gray.

(Attacks cotton worms: also Diptera.)

Exhibit: Adult.

SIX-SPOTTED TIGER BEETLE.

Cicindela sexguttata Fab.

Exhibit: Adult.

CAROLINA TIGER BEETLE.

Tetracha carolina Linn.

(Feeds occasionally upon cotton worms.)

Exhibit: Adult.

SUBTERRANEAN GROUND BEETLE.

Scarites subterraneus Fab.

Exhibit: Adult.

PTEROSTICHUS PERMUNDUS Say.

Exhibit: Adult.

HELLUOMORPHA TEXANA Lec.

Exhibit: Adult.

GALERITA ATRIPES Lec.

Exhibit: Adult.

CALLIDA DECORA Fab.

Exhibit: Adult.

COCCINELLA SANGUINEA Linn.

(Attacks cotton aphis.)
EXHIBIT: Adult.

COCCINELLA OCULATA Fab.

EXHIBIT: Adult.

TWICE-STABBED LADYBIRD.

Chilocorus bivulnerus Muls.

(Attacks cotton Aleyrodes.)
EXHIBIT: Adult.

COLLOPS QUADRIMACULATUS Fab.

(Feeds on pollen, and probably on small insects.)
EXHIBIT: Adult.

ROBBER FLY.

Erax lateralis Macq.

(Observed to catch bollworm moths on the wing.)
EXHIBIT: Adult.

ASILUS SERICEUS Say.

(Observed to catch moths on the wing.)
EXHIBIT: Adult.

MESOGRAPTA POLITA Say.

(Feeds on aphids.)
EXHIBIT: Adult.

COTTON-WORM TACHINA FLY.

Frontina aletiæ Riley.

EXHIBIT: Adult.

HOLCOCEPHALA ABDOMINALIS Say.

EXHIBIT: Adult.

DIOGMITES DISCOLOR Loew.

EXHIBIT: Adult.

LAPHRIA THORACICA Fab.

EXHIBIT: Adult.

ATOMOSIA PUELLA Wied.

EXHIBIT: Adult.

ROBBER FLY.

Proctacanthus milberti Macq.

(Observed to attack cotton worm.)
EXHIBIT: Adult.

ISODONTIA PHILADELPHICA Lep.

(Preys upon crickets.)
EXHIBIT: Adult.

AMMOPHILA PICTIPENNIS Walsh.

(Preys on caterpillars.)

Exhibit: Adult.

POLISTES RUBIGINOSUS Lep.

Exhibit: Adult.

COMPSOMERUS QUADRINOTATA Fab.

Exhibit: Adult.

LYSIPHLEBUS TESTACEIPES Cress.

(Cotton aphis parasite: "Fairly cleaned cotton of aphids.")

Exhibit: Adult.

OPHION BILINEATUS Say.

Exhibit: Adult.

SPILOCRYPTUS NUNCIUS Say.

(Bred from cotton worm.)

Exhibit: Adult.

SYNTOMOSPHYRUM ESURUS Riley.

(Bred from cotton worm.)

Exhibit: Adult.

EUPLECTRUS COMSTOCKII How.

(Bred from cotton worm and boll worm.)

Exhibit: Adult.

INSECTS INJURIOUS TO INDIAN CORN.

Treating of injuries to seed in ground and roots see Forbes, 18th Rept. St. Ent. Ill., pp. 7–171, Pls. I–XV, 1894.

For general articles see Webster, 35th Ann. Rpt. Ind. St. Bd. Agric. f. 1885, pp. 180–215, 1886; Bruner, Rpt. Nebr. St. Bd. Agr. f. 1891, pp. 240–309, 1892.

INJURING THE PLANTED SEED.

THE SEED-CORN MAGGOT.

Pegomya fusciceps Zett.

(Formerly *Pegomyia zeæ* Riley.)

For general articles see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 84–92, 1902; Forbes 18th Rpt. St. Ent. Ill., pp. 16–19, 1894.

Exhibit: Pupa, adult, and work.

SEED-CORN AGONODERUS.

Agonoderus pallipes Fab.

For general account see Forbes, 18th Rpt. St. Ent. Ill., pp. 12–14, 1894.

Exhibit: Adult and work.

LITTLE BLACK ANT.

Prenolepis imparis Say.

(Adults eat sprouting corn; also called *P. nitens* Mayr., which is a European variety of the species.)

Exhibit: Adult.

THE SMALL YELLOW ANT.

Solenopsis debilis Mayr.

For general article see Forbes, 18th Rpt. St. Ent. Ill., pp. 9–11, 66, 1894.

Exhibit: Adult and figure.

THE VAGABOND CRAMBUS.

Crambus vulgivagellus Clem.

For general account see Lintner, 1st Rpt. St. Ent. N. Y., pp. 127–157, 1882; Felt. Bul. 64, Cornell Univ. Agr. Expt. Sta., pp. 69–71, 1894.

Exhibit: Adult and figure.

THE CORN-ROOT WEBWORM.

Crambus zeellus Fern.

(Larvæ feed on roots; when full grown form a webbed cocoon near base of stalk.)

For general account see Forbes, 14th Rpt. St. Ent. Ill., pp. 12–17, 1885.

Exhibit: Pupa, cocoon, and adult.

INJURING THE ROOTS AND SEEDS.

THE CORN-ROOT APHIS.

Aphis maidis-radicis Forbes.

For detailed account see Forbes, 18th Rpt. St. Ent. Ill., pp. 58–85, 1894.

Exhibit: Adult and figure.

WHITE GRUB; MAY BEETLE.

Lachnosterna fusca Fröh.

For account of white grubs injuring corn see Forbes, 18th Rpt. St. Ent. Ill., pp. 109–145, 1894.

Exhibit: Adult.

LACHNOSTERNA GIBBOSA Burm.

For general account of white grubs see Forbes, 18th Rpt. St. Ent. Ill., pp. 109–145, 1894.

Exhibit: Adult.

THE WHEAT WIREWORM.

Agriotes mancus Say.

For general account see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 77–78, 1901.

Exhibit: Adult and figure.

THE CORN WIREWORM.

Melanotus cribulosus Lec.

For injuries by wire-worms see Forbes, 18th Rpt St. Ent. Ill., pp. 27–51, 1894.

Exhibit: Adult and figure.

THE COMMON WIREWORM.

Melanotus communis Gyll.

For injuries by wire-worms see Forbes, 18th Rpt. St. Ent. Ill., pp. 27–51, 1894.

Exhibit: Adult.

TWELVE-SPOTTED CUCUMBER-BEETLE.

Diabrotica duodecempunctata Oliv.

For general articles see Forbes, 18th Rpt. St. Ent. Ill., pp. 146–154, 1894; Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 12–13, 1903; Quaintance, Bul. 26, n. s., Div. Ent., U. S. Dept. Agric., pp. 35–40, 1900.

Exhibit: Adult and figure. (See also, under "Injuring the Ears.")

THE NORTHERN CORN ROOT-WORM.

Diabrotica longicornis Say.

For general account see Forbes, 18th Rpt. St. Ent. Ill., pp. 154–165, 1894.

Exhibit: Adult and figure.

INJURING THE YOUNG PLANT.

CORN BILL-BUGS.

For general articles on corn bill-bugs see Forbes, 16th Rpt. St. Ent. Ill., pp. 58–74, 1890; Bul. 79, Ill. Agr. Expt. Sta., 27 pp. 1902.

THE CLAY-COLORED BILL-BUG.

Sphenophorus æqualis Linn.

(Treated as *S. ochreus* Lec, by Forbes, l. c.)

Exhibit: Adult and figure.

NORTHERN CORN BILL-BUG.

Sphenophorus zeæ Walsh.

(Generally called by authors *S. sculptilis.*)

Exhibit: Adult and work.

THE TENACIOUS BILL-BUG.

Sphenophorus pertinax Oliv.

Exhibit: Adult.

THE BLUE-GRASS BILL-BUG.

Sphenophorus parvulus Gyll.

Exhibit: Adult.

THE CALLOUSED BILL-BUG.

Sphenophorus callosus Oliv.

EXHIBIT: Adult.

THE FALL ARMY WORM.

Laphygma frugiperda S. & A.

(Larvæ feed on leaves, burrow in young plants, and later leaves and forming ears are damaged.)

For full life history and bibliography see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 13–45, 1901.

EXHIBIT: Larva and adult.

THE ARGE TIGER MOTH.

Apantesis arge Dru.

For brief account see Bruner, Rpt. Nebr. St. Bd. Agr. 1891, p. 244, 1892. (Formerly *Arctia.*)

EXHIBIT: Larva, pupa, and adult.

YELLOW-BEAR CATERPILLAR.

Diacrisia virginica Fab.

For general account see Lugger, 4th Rpt. State Entom. Minn., pp. 79–81, fig. 78, 1899. (Formerly *Spilosoma.*)

EXHIBIT: Larva, cocoon, and adult.

SALT-MARSH CATERPILLAR.

Estigmene acræa Dru.

For short account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 43–44, fig. 41, 1903. (Formerly *Leucarctia.*)

EXHIBIT: Larva and adult.

THE SADDLE-BACK CATERPILLAR.

Sibine stimulea Clem.

For general account see Lugger, 4th Rpt. State Ent. Minn., pp. 98–99, 1899. (Formerly *Empretia.*)

EXHIBIT: Larva, pupa, cocoon, and adult.

THE DARK-SIDED CUTWORM.

Euxoa messoria Harr.

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 290–291, 1885. (Formerly *Carneades.*)

EXHIBIT: Larva, adult, and figure.

THE BRONZED CUTWORM.

Nephelodes minians Guen.

For life history and partial bibliography see Lintner, 1st Rpt. St. Ent. N. Y., pp. 99–110, 1882; Riley, Rpt. U. S. Dept. Agric., 1890, pp. 244–246, 1891.

EXHIBIT: Adult.

THE W-MARKED CUTWORM.

Noctua clandestina Harr.

For general account see Slingerland, Bul. 104, Cornell Univ. Agr. Expt. Sta., pp. 571–574, 1895.

Exhibit: Larva and adult.

THE SPOTTED CUTWORM.

Noctua c-nigrum Linn.

For general account and life history see Chittenden, Bul. 27, n. s., Div. Ent. U. S. Dept. Agric., pp. 54–58, 1901.

Exhibit: Larva, pupa, adult, and figure.

THE VARIEGATED CUTWORM.

Peridroma saucia Hübn.

For general bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent. U. S. Dept. Agric., pp. 46–64, 1901.

Exhibit: Adult and figure.

THE GLASSY CUTWORM.

Hadena devastatrix Brace.

For general account see Riley, Rpt. U. S. Dept. Agric. 1884, pp. 296–297, 1885.

Exhibit: Adult.

THE BLACK CUTWORM.

Agrotis ypsilon Rott.

For general account see Riley, Rpt. U. S. Dept. Agric. 1884, pp. 294–295, 1895.

Exhibit: Larva, adult and figure.

WESTERN STRIPED CUTWORM.

Feltia herilis Grote.

For short account see Riley, 1st Rpt. St. Ent. Mo., pp. 81–82, 1869; Forbes: 16th Rpt. St. Ent. Ill., p. 89, 1894.

Exhibit: Larva and adult.

THE DINGY CUTWORM.

Feltia subgothica Haw.

For general articles see Chittenden, Yearbook, U. S. Dept. Agric., 1898, p. 257. Slingerland, Bul. 104, Cornell Univ. Agr. Expt. Sta., pp. 574–579, 1895.

Exhibit: Larva, adult and figure.

INJURING THE STALK.

THE SPINDLE WORM.

Achatodes zeæ Harr.

For brief accounts see Harris, Ins. Inj. to Veg., Flint Ed., pp. 438–439, 1862; Webster, 35th Ann. Rpt. Ind. St. Bd. Agric., f. 1885, p. 193, 1886.

Exhibit: Adult and work.

SMALLER CORN STALK-BORER.

Elasmopalpus lignosellus Zell.

For life-history and general account see Chittenden, Bul. 23, n. s., Div. Ent. U. S. Dept. Agric. pp. 17–22, 1900.

Exhibit: Adult work and cocoon.

THE STALK BORER.

Papaipema nitela Guen.

(Formerly *Gortyna* and *Hydrœcia.*)

For general accounts see Bird, Can. Ent., v. XXX, pp. 127–128, 1898; Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 11–12, fig. 2, 1902.

Exhibit: Adult.

CORN STALK-BORER; SUGAR-CANE BORER.

Diatræa saccharalis Fab.

For full life-history and general account see Howard, Insect life, v. IV, pp. 95–103, 1891.

Exhibit: Eggs, larva, pupa, adult, and work.

INJURING THE LEAVES.

THE LESSER LOCUST.

Melanoplus atlanis Riley.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 178–183, pl. 12, fig. 7, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 26–27, 1891.

Exhibit: Adult.

THE TWO-STRIPED LOCUST.

Melanoplus bivittatus Say.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 363–368, pl. 24, fig. 5, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 31–32.

Exhibit: Adult.

THE DIFFERENTIAL LOCUST.

Melanoplus differentialis Thos.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 349–354, pl. 23, figs. 3 and 4, 1897; also Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., pp. 7–26, 1901.

Exhibit: Adult.

RED-LEGGED LOCUST.

Melanoplus femur-rubrum DeG.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 278–285, pl. 1, fig. h., pl. 19, figs. 1–4, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 27–28, 1891.

Exhibit: Adult.

THE ROCKY-MOUNTAIN LOCUST.

Melanoplus spretus Thos.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 184–190, pl. 12, fig. 8, 1897; also Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 7–26, 1891.

Exhibit: Adult.

THE AMERICAN LOCUST.

Schistocerca americana Dru.

For life history and general account, Howard, Insect Life, v. VII, pp. 220–229, 1894; also Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., p. 27, 1901.

Exhibit: Adult.

THE CORN APHIS.

Aphis maidis Fitch.

For general account see Forbes, 13th Rpt. St. Ent. Ill., pp. 43–50, 1884.

Exhibit: Figure.

THE BARRED-WINGED ONION MAGGOT.

Chætopsis ænea Wied.

For general accounts see Howard, Insect Life, v. VII, pp. 352–354, 1895; Pettit, Bul. 200, Mich. Agr. Exp. Sta., pp. 206–208, 1902.

Exhibit: Puparium and adult.

THE CHINCH BUG.

Blissus leucopterus Say.

(Injures cane, corn, oats, rye, wheat, etc.)

For bibliography, 1786–1888, see Forbes, App. to 16th Rpt. St. Ent. Ill., pp. 1–102, 1894.

For general articles see Forbes, 16th Rpt. St. Ent. Ill., pp. 1–57, 1894; Webster, Bul. 15, n. s., Div. Ent., U. S. Dept. Agric., 82 pp., 1898.

Exhibit: Nymph, adult, and figure.

THE FODDER WORM.

Epizeuxis æmula Hübn.

(Lives especially on leaves of stored fodder.)

For general account see Packard, 5th Rpt. U. S. Ent., Comm., pp. 843–844, 1890.

Exhibit: Larva, pupa, cocoon, adult, and work.

THE ARMY WORM.

Heliophila unipuncta Harv.

(Formerly *Leucania*.)

For bibliography and life history see Lintner, 12th Rpt. St. Ent. N. Y., pp. 190–214, 1896.

Exhibit: Larva and adult.

THE CORN-FEEDING SYRPHUS-FLY.

Mesograpta polita Say.

For general account see Riley and Howard, Insect Life, v. I, pp. 5–8, 1888.

Exhibit: Puparia and adult.

THE STRIPED BLISTER BEETLE.

Epicauta vittata Fab.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 22–23, 1903.

Exhibit: Pupa, adult, and figure.

BLACK BLISTER BEETLE.

Epicauta pennsylvanica DeG.

(Feed on pollen and flower leaves.)

For brief account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 25, 1903.

Exhibit: Adult.

THE GRAY BLISTER BEETLE.

Epicauta cinerea Fors.

For brief account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 24, 1903.

Exhibit: Adult.

INJURING THE POLLEN, SILK, AND EARS.

BOLLWORM; CORN-EAR WORM.

Heliothis obscura Fab.

(Formerly *H. armiger* Hübn; see special case.)

For life history and general account see Quaintance, Farmer's Bul. 191, U. S. Dept. Agric., 1904.

Exhibit: Adult.

THE BROWN FRUIT-CHAFER.

Euphoria inda Linn.

For life history and general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 67–74, 1899.

Exhibit: Adult and work.

THE ROSE-CHAFER.

Macrodactylus subspinosus Fabr.

For general article and life history see Smith, Bul. 82, N. J. Agric. Expt. Sta., 1891.

Exhibit: Adult and figure.

THE RUSTY-BROWN TORTRIX.

Platynota flavedana Clem.

(Larvæ feed in ears of green corn.)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 231–239, 1899.

Exhibit: Pupa and adult.

INSECTS INJURING SUGAR CANE.

THE SUGAR-CANE PIN-BORER.

Xyleborus sacchari Hopk.

For notes, under name of *X. pubescens* Zim., see Riley and Howard, Insect Life, v. IV, p. 402, and v. V, p. 51, 1892.

Exhibit: Adult, work, and figure.

HAWAIIAN SUGAR-CANE BORER.

Sphenophorus obscurus Boisd.

For life history and general account see Riley and Howard, Insect Life, v. I, pp. 185–189, 1888.

Exhibit: Adult and figure.

THE SUGAR-CANE BEETLE.

Ligyrus rugiceps Lec.

For general account see Howard, Insect Life, v. I, pp. 11–13, 1888.

Exhibit: Adult and work.

CORN STALK-BORER; SUGAR-CANE BORER.

Diatræa saccharalis Fab.

For full life history and general account see Howard, Insect Life, v. VI, pp. 95–103, 1891.

Exhibit: Larva, pupa, adult, and work.

INSECTS INJURIOUS TO RICE.

THE RICE WEEVIL.

Calandra oryza Linn.

For general account see Chittenden, Farmers' Bul. 45, rev. ed., U. S. Dept. Agric., pp. 5–6, 1897.

Exhibit: Adult and figure.

THE RICE GRUB.

Chalepus trachypygus Burm.

For general article see Riley, Rpt. U. S. Dept. Agric., 1881, pp. 128–129, 1882.

Exhibit: Adult and figure.

THE RICE STALK-BORER.

Chilo plejadellus Zinck.

For general article under *Chilo oryzaellus* see Riley, Rpt. U. S. Dept. Agric. f. 1881, pp. 133–135, 1882.

Exhibit: Larva, adult, work, figure and the parasite *Phora aletiæ* Comst.

THE RICE WATER-WEEVIL.

Lissorhoptrus simplex Say.

For general article see Riley, Rpt. U. S. Dept. Agric. f. 1881, pp. 130–133, 1882.

Exhibit: Adult and figure.

THE FALL ARMY WORM.

Laphygma frugiperda S. & A.

For full life history and bibliography see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 13–45, 1901.

Exhibit: Larva, pupa, adult, and figure.

INSECTS INJURIOUS TO GRASSES.

APANTESIS NAIS Dru.

(Formerly *Arctia.*)

For account see Beutenmüller, "Cat. Lep. N. Y.," Ann. Acad. N. Y., p. 206, 1890.

Exhibit: Adult.

GRANULATED CUTWORM.

Feltia annexa Fr.

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 291–292, 1885. For description and stages see French, Can. Ent., v. XIV, pp. 207–210, 1882.

Exhibit: Adult and figure.

HOMOPTERA EDUSA Dru.

Exhibit: Larva, pupa, and adult.

NORTHERN GRASS WORM.

Drasteria erechtea Cram.

For general account see Slingerland, Insect Life, v. V, pp. 87–88, 1892.

Exhibit: Larva, pupa, adult, and work.

THE ARMY WORM.

Heliophila unipuncta Harv.

(Formerly *Leucania*).

For bibliography and life history see Lintner, 12th Rpt. St. Ent. N. Y., pp. 190–214, 1896.

Exhibit: Larva, pupa, adult, and figure.

THE SALT-MARSH CATERPILLAR.

Estigmene acræa Dru.

(Formerly *Leucarctia.*)

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 43–44, 1903.

Exhibit: Larva and adult.

FALL ARMY WORM.

Laphygma frugiperda S. & A.

For full bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 40–45, 1901.

Exhibit: Larva, pupa, adult, and figure.

THE ISABELLA TIGER MOTH.

Isia isabella S. & A.

(Formerly *Pyrrharctia.*)

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 44–45, 1903.

Exhibit: Larva, cocoon, adult and figure.

THE VAGABOND CRAMBUS.

Crambus vulgivagellus Clem.

For general accounts see Lintner, 1st Rpt. St. Ent. N. Y., pp. 127–151, 1882; Felt, Bul. 64, Cornell Univ. Agric. Expt. Sta., pp. 69–71, 1894.

Exhibit: Eggs, adult, work, figure, and parasite *Lampronotus frigida* Cr.

THE SPOTTED CUTWORM.

Noctua c-nigrum Linn.

For general account and life history see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 54–58, 1901.

Exhibit: Pupa and adult.

WHITE GRUB; MAY BEETLE.

Lachnosterna fusca Fröh.

For account of white grubs see Forbes, 18th Rpt. St. Ent. Ill., pp. 109–145, 1894.

Exhibit: Adult.

WHITE GRUB; JUNE BEETLE.

Lachnosterna arcuata Smith.

For general account see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 74–76, 1901.

Exhibit: Adult and figure.

THE DISTENDED MAY BEETLE.

Lachnosterna farcta Lec.

For short notices see Comstock, Rpt. U. S. Dept. Agric. 1879, pp. 247–248, Pl. V, fig. 5, 1880, and Howard, Bul. 22, n. s., Div. Ent., U. S. Dept. Agric., p. 107, 1900.

Exhibit: Adult.

THE BLUE-GRASS BILL-BUG.

Sphenophorus parvulus Gyll.

For article see Forbes, 16th Rpt. St. Ent. Ill., pp. 63, 65, 1894.

Exhibit: Adult.

THE LESSER LOCUST.

Melanoplus atlanis Riley.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 178–183, pl. 12, fig. 7, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 26–27, 1891.

Exhibit: Adult.

THE CAROLINA LOCUST.

Dissosteira carolina Linn.

For short account see Forbes and Hart, Bul. 60, Ill. Agric. Expt. Sta., pp. 479–480, 1900.

Exhibit: Nymph and adult.

THE TIMOTHY PLANT-BUG.

Oncognathus binotatus Fabr.

For general account see Howard, Insect Life, v. V, pp. 90–92, 1892.

Exhibit: Adult.

THE GREATER WHEAT-STEM MAGGOT.

Meromyza americana Fitch.

For general article see Webster, Bul. 42, Div. Ent., U. S. Dept. Agric., pp. 43–51, 1903.

Exhibit: Adult and figure.

LEATHER JACKET; MEADOW WORM.

Tipula bicornis Loew.

For general account see Forbes, 16th Rpt. St. Ent. Ill., pp. 78–83, 1890.

Exhibit: Adult and figure.

INSECTS INJURIOUS TO ALFALFA.

THE VARIEGATED CUTWORM.

Peridroma saucia Hübn.

For general bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent. U. S. Dept. Agric., pp. 46–64, 1901.

Exhibit: Larva and adult.

THE FALL ARMY WORM.

Laphygma frugiperda S. & A.

For full bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent. U. S. Dept. Agric., pp. 40–45, 1901.

Exhibit: Larva and adult.

THE ALFALFA WEBWORM.

Loxostege commixtalis Walk.

(Formerly *L. cereralis* Zell.)

For account of *Loxostege* sp. attacking alfalfa see Insect Life, v. VI, pp. 36, 1893.

Exhibit: Adult.

THE TWO-STRIPED LOCUST.

Melanoplus bivittatus Say.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 363–368, pl. 24, fig. 5, 1897.

Exhibit: Adult and figure.

THE DIFFERENTIAL LOCUST.

Melanoplus differentialis Thos.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 349–354, pl. 23, figs. 3 and 4, 1897; also Morgan, Bul. 30, n. s., Div. Ent. U. S. Dept. Agric., pp. 7–26, 1901.

Exhibit: Adult and figure.

THE ROCKY-MOUNTAIN LOCUST.

Melanoplus spretus Thos.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 184–190, pl. 12, fig. 8, 1897.

Exhibit: Adult.

THE AMERICAN LOCUST.

Schistocerca americana, Dru.

For life history and general account see Howard, Insect Life, v. VII, pp. 220–229, 1897; also Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., p. 27, 1901.

Exhibit: Adult.

THE CLOVER-SEED CHALCIS-FLY.

Bruchophagus funebris How.

For general account see Hopkins, Bul. 6, n. s., Div. Ent. U. S. Dept. Agric., p. 73, 1896, and Bul. 17, n. s., p. 45, 1898; Titus, Bul. 44, pp. 77–80, 1904.

Exhibit: Adult and work.

INSECTS INJURIOUS TO SMALL GRAINS.

For general articles see Howard, Tech. Ser. 2, Div. Ent. U. S. Dept. Agric., 24 pp., 1896; Marlatt, Farmers' Bul. 132, U. S. Dept. Agric., 38 pp., 1901; Webster, Bul. 42, Div. Ent., U. S. Dept. Agric., 62 pp., 1903.

THE LESSER LOCUST.

Melanoplus atlanis Riley.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 178–183, pl. 12, fig. 7, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 26–27, 1891.

Exhibit: Nymph and adult.

THE RED-LEGGED LOCUST.

Melanoplus femur-rubrum DeG.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 278–285, pl. 1, fig. h; Pl. IX, figs. 1–4, 1897; Riley, Bul. 25, Div. Ent. U. S. Dept. Agric., pp. 27–28, 1891.

Exhibit: Nymph and adult.

THE ROCKY MOUNTAIN LOCUST.

Melanoplus spretus Thos.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 184–190, pl. 12, fig. 8, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 9–26, 1891.

Exhibit: Nymph, adult, and figure.

THE WESTERN CRICKET.

Anabrus purpurascens Uhl.

For detailed account see Packard, 2d Rept. U. S. Ent. Comm., pp. 163–178, 1879.

Exhibit: Adult.

THE CLEAR-WINGED LOCUST.

Camnula atrox Scudd.

For account of an allied species (*C. pellucida*) see Simpson, Circ. 53, Div. Ent., U. S. Dept. Agric., 1903.

Exhibit: Adult.

THE ARMY WORM.

Heliophila unipuncta Harv.

(Formerly *Leucania.*)

For bibliography and life history see Lintner, 12th Rept. St. Ent. N. Y., pp. 190–214, 1896.

Exhibit: Larva, pupa, adult, and figure.

FALL ARMY WORM.

Laphygma frugiperda S. & A.

For full bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 40–45, 1901.

Exhibit: Larva, pupa, and adult.

STALK BORER.

Papaipema nitela Guen.

(Bores in stems of various plants.)

For general account see Bird, Can. Ent., v. XXX, pp. 127–128, 1898.

Exhibit: Larva, pupa, adult, and work.

WHEAT-HEAD ARMY-WORM.

Heliophila albilinea Hübn.

For general account see Riley, 9th Rept. St. Ent. Mo., pp. 50–57, 18.

Exhibit: Pupa, adult, figure, and parasites: *Anomalon apicale* Cress., *Tachina anonyma* Riley.

NUTTALL'S BLISTER BEETLE.

Cantharis nuttalli Say.

For short article see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 27, 1903.

Exhibit: Adult.

THE CLAY-COLORED BILL-BUG.

Sphenophorus æqualis Lec.

(Treated as *S. ochreus* Lec. by authors.)

For articles on bill-bugs see Forbes, 16th Rept. St. Ent. Ill., pp. 58–74, 1890; Webster, Insect Life, v. II, pp. 132–134, 1889.

Exhibit: Adult.

THE GERMAN GRAIN-LOUSE.

Macrosiphum cerealis Kalt.

(Attacks barley, chess, meadow, orchard, and velvet grass, oats, rye, and wheat, feeding on ears, racemes, and other parts of plant.)

For general account see Pergande, Bul. 44, Div. Ent., U. S. Dept. Agric., pp. 18–21, 1904.

Exhibit: Figure.

THE ENGLISH GRAIN-LOUSE.

Macrosiphum granaria Buck.

(Formerly *Nectarophora* and *Aphis*. Attacks green foxtail, meadow, and orchard grass, oats, red-clover, red top, rye, wheat, and wild rye.)

For general account see Pergande, Bul. 44, Div. Ent., U. S. Dept. Agric., pp. 13–18, 1904.

Exhibit: Figure and work; parasite, *Lysiphlebus testaceipes* Cress. (figure); and enemies, *Anatis 15-punctata* Ol.; *Coccinella sanguinea* Linn.; *Hippodamia parenthesis* Say; *Podabrus tomentosus* Say; *Sphærophoria cylindrica* Say; *Syrphus americanus* Wied.

THE EUROPEAN GRAIN-LOUSE.

Siphocoryne avenæ Fabr.

(Formerly *Nectarophora* and *Aphis*. Attacks apple, burdock, celery, choke-cherry, dogwood, grasses, oats, rye, wheat, and other plants.)

For general account see Pergande, Bul. 44, Div. Ent., U. S. Dept. Agric., pp. 5–13, 1904.

Exhibit: Figure.

THE CHINCH BUG.

Blissus leucopterus Say.

(Injures cane, corn, oats, rye, wheat, etc.)

For bibliography 1785–1888 see Forbes, App. to 16th Rept. St. Ent. Ill., pp. 1–102, 1894. For general articles see Forbes, 16th Rept. St. Ent. Ill., pp. 1–57, 1894; Webster, Bul. 15, n. s., Div. U. S. Dept. Agric., 82 pp., 1898.

Exhibit: Eggs, nymph, adult, and figure.

THE GRAIN LEAF-HOPPER.

Diedrocephalus flaviceps Riley.

For account of *D. mollipes* see Osborn & Ball, Bul. 34, Iowa Agric. Expt. Sta., p. 614, 1897.

EXHIBIT: Adult.

THE DESTRUCTIVE LEAF-HOPPER.

Cicadula exitiosa Uhl.

For general account see Comstock, Rpt. U. S. Comm. Agric., 1879, pp. 191-193, 1880.

EXHIBIT: Adult.

THE WHEAT FALSE WORM.

Dolerus arvensis Say.

For general account see Riley and Marlatt, Insect Life, v. IV, pp. 171–172, 1891.

EXHIBIT: Adult and figure.

THE GRASS SAWFLY.

Pachynematus extensicornis Nort.

(Formerly *Nematus marylandicus.*)

For article under *N. marylandicus* see Riley and Marlatt, Insect Life, v. IV, pp. 174–177, 1891.

EXHIBIT: Adult and figure.

THE WESTERN GRAIN SAWFLY.

Cephus occidentalis Marl.

For short article see Riley and Howard, Insect Life, v. II, p. 286, 1890.

EXHIBIT: Adult, work and figure.

JOINT-WORMS.

For special articles to four following species see Howard, Tech. Ser. 2, Div. Ent., U. S. Dept. Agric., 24 pp., 1896; also Webster, Bul. 42, Div. Ent., U. S. Dept. Agric., 62 pp., 1903.

GREATER WHEAT-STRAW WORM.

Isosoma grande Riley.

EXHIBIT: Adult and figure.

BARLEY-STRAW WORM.

Isosoma hordei Harr.

EXHIBIT: Adult, work and figure.

THE WHEAT JOINT-WORM.

Isosoma tritici Riley.

EXHIBIT: Adult, work and figure.

THE HAIRY-FACED JOINT-WORM.

Isosoma hirtifrons How.

EXHIBIT: Adult and figure.

THE HESSIAN FLY.

Mayetiola destructor Say.

(Formerly *Cecidomyia*.)

For general article with bibliography see Osborn, Bul. 16, n. s. Div. Ent., U. S. Dept. Agric., 57 pp., 1898; Marlatt, Farmers' Bul. 132, U. S. Dept. Agric., pp. 13–22, 1901.

Exhibit: Puparia, adult, work, figures, and map.

THE GREATER WHEAT-STEM MAGGOT.

Meromyza americana Fitch.

For general article see Webster, Bul 42, Div. Ent., U. S. Dept. Agric., pp. 43–51, 1903.

Exhibit: Adult, work and figure.

THE AMERICAN FRIT-FLY.

Oscinis soror Macq.

For general article see Webster, Bul. 42, Div. Ent., U. S. Dept. Agric., pp. 57–62, 1903.

Exhibit: Adult, work, and figure.

THE LESSER WHEAT-STRAW MAGGOT.

Oscinis carbonaria Loew.

For general article see Webster, Bul. 42, Div. Ent., U. S. Dept. Agric., pp. 51–56, 1903.

Exhibit: Adult.

CHLOROPS PROXIMA Say.

For short account see Comstock, Rpt. U. S. Comm. Agric., 1879, pp. 257–258, 1880.

Exhibit: Adult and work.

INSECTS INJURIOUS TO HOPS.

THE HOP PLANT-LOUSE.

Phorodon humuli Schr.

(Attacks hop and plum.)

For full life history see Riley, Cir. 2, Div. Ent., U. S. Dept. Agric., 1891.

Exhibit: Adult, work, and figures, with two enemies: *Chrysopa* sp. and *Adalia bipunctata* Linn.

THE COMMA BUTTERFLY.

Polygonia comma Harr.

(Formerly *Grapta*.)

For general account see Howard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 50–51, 1897.

Exhibit: Larva and adult.

THE SEMICOLON BUTTERFLY.

Polygonia interrogationis Fab.

For general account see Howard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 47–49, 1897.

Exhibit: Larva and adult.

THE HOP GRUB.

Gortyna immanis Guen.

For general account and life history see Howard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 40–44, 1897.

Exhibit: Pupa, adult, and work.

THE HOP SNOUT-MOUTH.

Hypena humuli Harr.

For general account see Howard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 44–47, 1897.

Exhibit: Larva, pupa and adult.

THE VARIEGATED CUTWORM.

Peridroma saucia Hübn.

For general bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent,, U. S. Dept. Agric., pp. 46–64, 1901.

Exhibit: Larva and adult.

INSECTS INJURIOUS TO CLOVER.

For list of clover insects, and short articles on several important species see Bruner and Hunter, Rpt. St. Bd. Agr. Nebr., pp. 240–285, 1898.

INJURING THE ROOTS.

THE CLOVER ROOT-BORER.

Hylastinus trifolii Müll.

(Formerly *Hylastes.*)

For general articles see Riley, Rpt. U. S. Dept. Agr., f. 1878, pp. 248–250, 1879.

Exhibit: Adult, work, figure, and enemy, *Telephorus bilineatus* Say.

INJURING THE STEM.

THE CLOVER STEM-BORER.

Languria mozardi Latr.

For general account see Weed, Bul. Ohio Agr. Expt. Sta., 2d series, v. III, No. 8, p. 235, 1890.

Exhibit: Adult.

INJURING THE LEAVES.

THE CLOVER MITE.

Bryobia pratensis Garm.

For general article see Garman, 14th Rpt. St. Ent. Ill., p. 73, 1885; Bruner, Rpt. Nebr. St. Bd. Agric., f., 1898, pp. 280–284, 1899; Marlatt, Cir. 19, Div. Ent., U. S. Dept. Agric., 1897.

Exhibit: Figure.

CLOVER ALEYRODES.

Aleyrodes sp.

Exhibit: Adult and work.

THE WHEAT THRIPS.

Thrips tritici Fitch.

For citations to literature see Lintner, 11th Rpt. N. Y. St. Ent., pp. 247–250, 1896.

Exhibit: Figure.

THE CLOVER-LEAF WEEVIL.

Phytonomus punctatus Fabr.

For general account see Lintner, 1st. Rpt. St. Ent. N. Y., pp. 247–253, 1883; Sanderson, Insects injurious to staple crops, pp. 177–179, 1902.

Exhibit: Larva, cocoon, adult, work, figure, and enemy, *Collops 4-maculatus* Fab.

THE GRAPE-VINE COLASPIS.

Colaspis brunnea Fab.

For general article see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 13–14, 1903.

Exhibit: Adult.

THE 12-SPOTTED CUCUMBER BEETLE.

Diabrotica duodecimpunctata Oliv.

For general account and remedies see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 12–13, 1903; Quaintance, Bul. 26, n. s., Div. Ent., U. S. Dept. Agric., pp. 35–40, 1900.

Exhibit: Adult, figure, and parasite, *Celatoria diabroticæ.*

WESTERN CORN ROOT-WORM.

Diabrotica longicornis Say.

For general account see Forbes, 12th Rpt. St. Ent. Ill., pp. 10–31, figs. 1–5, 1883.

Exhibit: Adult.

THE IMBRICATED SNOUT-BEETLE.

Epicærus imbricatus Say.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 28–29, 1903; Bul. 19, n. s., pp. 62–67, 1899.

Exhibit: Adult.

THE GIBBOUS JUNE-BEETLE.

Lachnosterna gibbosa Burm.

For general account of white grubs see Forbes, 18th Rpt. St. Ent. Ill., pp. 109–144, 1894.

Exhibit: Adult.

THE FLAVESCENT CLOVER-WEEVIL.

Sitones flavescens Marsh.

For brief account see Osborn and Gossard, Bul. 14, Ia. Agric. Expt. Sta., pp. 177–178, 1891.

Exhibit: Adult.

GRAPHORHINUS VADOSUS Say.

For brief account see Webster, Amer. Nat., v. XVI, p. 746, 1882.

Exhibit: Adult.

THE ASH-GRAY BLISTER-BEETLE.

Macrobasis unicolor Kby.

For general account see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 249–250.

Exhibit: Adult.

FOUR-LINED PLANT-BUG.

Pœcilocapsus lineatus Fab.

For general accounts see Lintner, 1st. Rpt. St. Ent. N. Y., pp. 271–281, 1883; Slingerland, Bul. 58, Cornell Univ. Agr. Expt. Sta., pp. 207–239, 1893.

Exhibit: Adult.

THE TARNISHED PLANT-BUG.

Lygus pratensis Linn.

For general account see Riley, Rpt. U. S. Dept. Agric., f. 1884, pp. 312–315, 1885.

Exhibit: Adult.

THE CLOVER-LEAF MIDGE.

Cecidomyia trifolii Loew.

For brief articles see Bruner, Rpt. St. Bd. Agric. Nebr., 1898, pp. 250–251, 1899; Comstock, Rpt. U. S. Dept. Agric., 1879, pp. 197–199, 1880.

Exhibit: Cocoon, adult, and work.

THE RED-BANDED LEAF-ROLLER.

Eulia triferana Walk.

(Formerly *Lophoderus.*)

For brief accounts see Lugger, 4th Rpt. State Ent. Minn., p. 231, 1899; Forbes, 14th Rpt. St. Ent. Ill., pp. 20–21, 1885.

Exhibit: Pupa and adult.

THE RUSTY-BROWN TORTRIX.

Platynota flavedana Clem.

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 231-232, 1899.

Exhibit: Eggs, pupa, and adult.

THE SULPHUR-COLORED TORTRIX.

Epagoge sulfureana Clem.

(Formerly *Tortrix* and *Dichelia.*)

For brief account see Lugger, 4th Rpt. S. Ent. Minn., pp. 232-233, 1899. For bibliography see Forbes, 14th Rpt. St. Ent. Ill., pp. 17–20, 1885.

Exhibit: Pupa, adult, and work.

CŒLOSTATHMA DISCOPUNCTANA Clem.

(Formerly *Amphisa.*)

For brief notice see Comstock, Rpt. U. S. Dept. Agric., f. 1880, p. 258, 1881.

Exhibit: Pupa and adult.

THE FALL ARMY WORM.

Laphygma frugiperda S. & A.

For full life history and bibliography see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 13–45, 1901.

Exhibit: Adult.

ANAPHORA POPEANELLA Clem.

For general account see Riley and Howard, Insect Life, v. III, pp. 27–28, 1890.

Exhibit: Adult.

THE OBLIQUE-BANDED LEAF-ROLLER.

Archips rosaceana Harr.

(Formerly *Cacœcia.*)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 226-227, 1899.

Exhibit: Pupa and adult.

THE GARDEN WEB-WORM.

Loxostege similalis Guen.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 39–40, 1903.

Exhibit: Adult and work.

ARISTOTELIA ROSEOSUFFUSELLA Clem.

(Formerly *Gelechia.*)

For brief reference to food plant see Murtfeldt, Bul. 23, Div. Ent., U. S. Dept. Agric., p. 54, 1891.

Exhibit: Pupa and adult.

ECTROPIS CREPUSCULARIA D. and S.

(Has been placed in genera *Cymatophora*, *Cleora*, and *Boarmia*.)

For brief accounts see Packard, 5th Rpt. U. S. Ent. Comm., p. 371, 1890; Lugger, 4th Rpt. St. Ent. Minn., p. 188, 1899.

Exhibit: Adult.

DRASTERIA ERECHTEA Cram.

For general account see Slingerland, Insect Life, vol. V, pp. 87–88, 1892.

Exhibit: Larva, cocoon, pupa, and adult.

THE CHICKWEED GEOMETER.

Hæmatopsis grataria Fabr.

For brief notice see Forbes, 14th Rpt. St. Ent. Ill., p. 74, 1885.

Exhibit: Adult.

IO MOTH.

Automeris io Fab.

For general account see Lugger, 4th Rpt. State Ent. Minn., pp. 126–129, fig. 130, and pl. 16, fig. 129, 1899.

Exhibit: Larva, cocoon, and adult.

CATOPYRRHA DISSIMILARIA Hübn.

(Formerly *Aspilates*.)

Exhibit: Adult.

THE GREEN CLOVER WORM.

Plathypena scabra Fab.

(Formerly *Hypena*.)

For accounts see Comstock, Rpt. U. S. Dept. Agric., 1879, p. 252, 1880, Chittenden, Bull. 30, n. s., Div. Ent., U. S. Dept. Agric., p. 44–50, 1901.

Exhibit: Larva, pupa, and adult.

THE SMALL WHITE BRISTLY CUTWORM.

Mamestra renigera Steph.

For short account see Forbes, 16th Rpt. St. Ent. Ill., pp. 95–96, 1890.

Exhibit: Larva, pupa, and adult.

THE CLOVER CUTWORM.

Mamestra trifolii Rott.

For account see Riley, Rpt. U. S. Dept. Agric. 1883, pp. 123–124, 1883.

Exhibit: Larva and adult.

ARMY WORM.

Heliophila unipuncta Harv.

(Formerly *Leucania*.)

For bibliography and life history see Lintner, 12th Rpt. N. Y. St. Ent., pp. 190–214, 1896.

Exhibit: Larva, pupa, and adult.

THE VARIEGATED CUTWORM.

Peridroma saucia Hübn.

For general bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 46–64, 1902.

Exhibit: Larva, adult, and figure.

THE COMMELINA OWLET MOTH.

Prodenia commelinæ S. & A.

For life history and general account see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 59–64, Pl. IV, fig. 1, 1901.

Exhibit: Larva, pupa, and adult.

THE DARK-SIDED CUTWORM.

Euxoa messoria Harr.

(Formerly *Carneades*.)

For general account see Riley, Rpt. U. S. Dept. Agric. f. 1884, pp. 290–291, 1885.

Exhibit: Larva and adult.

THE SMEARED DAGGER.

Apatela oblinita S. & A.

(Formerly *Acronycta*.)

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 567–568, 1890.

Exhibit: Larva, cocoon, and adult.

THE BRONZED CUTWORM.

Nephelodes minians Guen.

For life history and partial bibliography see Lintner, 1st Rpt. St. Ent. N. Y., pp. 99–110, 1882; Riley, Rpt. U. S. Dept. Agric. f. 1890, pp. 244–246, 1891.

Exhibit: Larva and adult.

THE CABBAGE LOOPER.

Autographa brassicæ Riley.

(Formerly *Plusia*.)

For general account and life history see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 60–69, 1902.

Exhibit: Larva, adult, and figure.

THE NAIS TIGER-MOTH.

Apantesis nais Dru.

For account see Beutenmuller, "Cat. Lepid. N. Y." Ann. Acad. N. Y., p. 206, 1890. (Formerly *Arctia*.)

Exhibit: Adult.

ZEBRA CATERPILLAR.

Mamestra picta Harr.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 42–43, 1903.

Exhibit: Larva and adult.

THE ISABELLA TIGER-MOTH.

Isia isabella S. & A.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 44–45, 1903. (Formerly *Pyrrharctia.*)

Exhibit: Larva and adult.

THE NORTHERN CLOUDY-WING.

Thorybes pylades Scud.

(Formerly *Eudamus.*)

Exhibit: Adult.

THE COMYNTAS BUTTERFLY.

Everes comyntas Godt.

(Formerly *Lycæna.*)

For brief account see Lintner, 4th Rpt. N. Y. St. Ent., p. 137, 1888.

Exhibit: Adult.

THE AMERICAN COPPER.

Heodes hypophlæas Bd.

(Formerly *Chrysophanus.*)

Exhibit: Adult.

LEMONIAS EDITHA Bd.

(Formerly *Melitæa.*)

Exhibit: Figure.

SOUTHERN DOG-FACE BUTTERFLY.

Zerene cæsonia Stoll.

(Formerly *Colias.*)

For brief notice see Thomas, 10th Rpt. St. Ent. Ill., p. 78, 1881; Howard, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., p. 84, 1897.

Exhibit: Adult.

THE ORANGE SULPHUR.

Eurymus eurytheme Bd.

(Formerly *Colias.*)

For brief account see French, 7th Rpt. St. Ent. Ill., pp. 147–148, 1878.

Exhibit: Larva and adult.

THE YELLOW BUTTERFLY.

Eurymus philodice Godt.

(Formerly *Colias.*)

For brief account see Davis, Bul. 116, Mich. Agr. Expt. Sta., p. 61, 1894.

Exhibit: Adult.

THE CLOUDLESS SULPHUR.

Callidryas eubule Linn.

For brief account see French, 7th Rpt. St. Ent. Ill., pp. 147-148, 1878.

Exhibit: Larva, pupa, and adult.

THE BLACK-BORDERED YELLOW.

Eurema nicippe Cram.

(Formerly *Terias.*)

For brief account see French, 7th Rpt. St. Ent. Ill., p. 148, 1878.

Exhibit: Larva, pupa, and adult.

THE LITTLE SULPHUR.

Eurema euterpe Men.

(Formerly *Terias lisa.*)

For brief account see French, 7th Rpt. St. Ent. Ill., p. 148, 1878.

Exhibit: Adult.

OLETHREUTES INSTRUTANA Clem.

Exhibit: Adult.

THE CLOVER HAY WORM.

Hypsopygia costalis Fab.

(Formerly *Asopia* and *Pyralis.*)

For bibliography and general account see Lintner, 11th Rpt. St. Ent. N. Y., pp. 145-151, 1896.

Exhibit: Larva and adult.

THE MEAL SNOUT-MOTH.

Pyralis farinalis Linn.

For short account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., pp. 10-11, 1897.

Exhibit: Larva, pupa, cocoon, and adult.

THE CLOVER PLANT-LOUSE.

Macrosiphum trifolii Perg.

(Attacks dandelion, oats, red clover, strawberry, wheat, &c.)

For general account see Pergande, Bul. 44, Div. Ent., U. S. Dept. Agric., pp. 21-23, 1904.

Exhibit: Figure.

THE TWO-STRIPED LOCUST.

Melanoplus bivittatus Say.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 363-368, pl. 24, fig. 5, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 31-32, 1891.

Exhibit: Adult and figure.

THE LESSER LOCUST.

Melanoplus atlanis Riley.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 178–183, pl. 12, fig. 7, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 26–27, 1891.

EXHIBIT: Adult.

THE DIFFERENTIAL LOCUST.

Melanoplus differentialis Thos.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 349–354, pl. 23, figs. 3 and 4; Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., pp. 7–26, 1901.

EXHIBIT: Adult.

RED-LEGGED LOCUST.

Melanoplus femur-rubrum DeG.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 278–285; pl. 1, fig. h; pl. 19, figs. 1–3, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 27–28, 1891.

EXHIBIT: Adult.

THE ROCKY-MOUNTAIN LOCUST.

Melanoplus spretus Thos.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., vol. XX, pp. 184–190, pl. 12, fig. 8, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 9–26, 1891.

EXHIBIT: Adult.

INJURING THE FLOWERS AND SEEDS.

THE CLOVER-FLOWER MIDGE.

Dasyneura trifolii Lint.

(Formerly *Cecidomyia leguminicola* Lint.)

For general account see Riley, Rpt. U. S. Dept. Agric., 1878, pp. 250–252, 1879.

EXHIBIT: Cocoon, adult, and figure.

THE CLOVER-SEED CHALCIS-FLY.

Bruchophagus funebris How.

For brief accounts see Hopkins, Bul. 6, n. s., Div. Ent., U. S. Dept. Agric., p. 73, 1896, and Bul. 17, n. s., p. 45, 1898; Titus, Bul. 44, Div. Ent., U. S. Dept. Agric., pp. 77–80, 1904.

EXHIBIT: Adult and work.

THE CLOVER-SEED WORM.

Enarmonia interstinctana Clem.

(Formerly *Grapholitha.*)

For bibliography and general account see Lintner, 11th Rpt. St. Ent. N. Y., pp. 152–157, 1896.

EXHIBIT: Pupa, adult, and work.

INSECTS INJURIOUS TO SUGAR BEET.

For general articles see Forbes and Hart, Bul. 60, Ill. Agr. Expt. Sta., 136 pp., 1900; Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., 71 pp., 1903.

RED-LEGGED LOCUST.

Melanoplus femur-rubrum DeG.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 278–285, pl. 1, fig. h. pl. 19, figs. 1–4, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 27–28, 1891.

Exhibit: Adult and figure.

THE DIFFERENTIAL LOCUST.

Melanoplus differentialis Thos.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 349–354, pl. 23, figs. 3 and 4, 1897; also Morgan, Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., pp. 7–26, 1901.

Exhibit: Adult and figure.

THE ROCKY-MOUNTAIN LOCUST.

Melanoplus spretus Thos.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 184–190, pl. 12, fig. 8, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 9–26, 1891.

Exhibit: Adult.

THE TWO STRIPED LOCUST.

Melanoplus bivittatus Say.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 363–368, pl. 24, fig. 5, 1897.

Exhibit: Adult, nymph, and figure.

THE LESSER LOCUST.

Melanoplus atlanis Riley.

For bibliography and general account see Scudder, Proc. U. S. N. M., v. XX, pp. 178–183, pl. 12, fig. 7, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 26–27, 1891.

Exhibit: Adult.

THE CAROLINA LOCUST.

Dissosteira carolina Linn.

For short account see Forbes and Hart, Bul. 60, Ill. Agr. Expt. Sta., pp. 479–480, 1900.

Exhibit: Nymph, adult, and parasite *Frontina frenchii* Will.

THE BEET LEAF-MINER.

Pegomya vicina Lint.

Exhibit: Adult and figure.

THE BEET CHLOROPS.

Chlorops assimilis Macq.

Exhibit: Puparium and adult.

THE COMMON ARMY WORM.

Heliophila unipuncta Harr.

(Formerly *Leucania*.)

For bibliography and life history see Lintner, 12th Rept. St. Ent. N. Y., pp. 190–214, 1896.

Exhibit: Larva and adult.

THE VARIEGATED CUTWORM.

Peridroma saucia Hübn.

For general bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 46–64, 1902.

Exhibit: Larva, adult, and figure.

THE PURSLANE CATERPILLAR.

Copidryas gloveri G. & R.

Exhibit: Larva and adult.

FALL ARMY WORM.

Laphygma frugiperda S. & A.

For full bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 40–45, 1901.

Exhibit: Larva, adult, and figure.

THE WHITE-LINED SPHINX.

Deilephila lineata Fabr.

Exhibit: Adult and figure.

THE BEET ARMY WORM.

Caradrina exigua Hübn.

For general articles see Gillette, 12th Rpt. Colo. Agr. Expt. Sta., p. 39, 1900; Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 37–46, 1902.

Exhibit: Adult and figure.

THE ZEBRA CATERPILLAR.

Mamestra picta Harr.

For bibliography and general life history see Felt, 14th Rpt. N. Y. St. Ent., pp. 201–207, 1898.

Exhibit: Larva and adult.

GARDEN WEB-WORM.

Loxostege similalis Guen.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 39–40, 1903.

Exhibit: Cocoon, adult, and figure.

THE SUGAR-BEET WEBWORM.

Loxostege sticticalis Linn.

For general account see Forbes, Bul. 60, Ill. Agr. Expt. Sta., p. 457–459, 1900.

Exhibit: Cocoon, pupa, adult, and figure.

THE ISABELLA TIGER MOTH.

Isia isabella S. & A.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 44–45, 1903. (Formerly *Pyrrharctia.*)

Exhibit: Larva, adult, and figure.

THE CLOVER CUTWORM.

Mamestra trifolii Rott.

For account see Riley, Rpt. U. S. Dept. Agric., 1883, pp. 123–124, 1883.

Exhibit: Larva, adult, and parasites *Ophion purgatum* Say, and *Euphorocera claripennis* Macq.

THE CABBAGE LOOPER.

Autographa brassicæ Riley.

For general account and life history see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 60–69, 1902.

Exhibit: Larva, adult, and parasite *Limneria tibiator* Cr

THE GARDEN FLEA-HOPPER.

Halticus uhleri Giard.

For general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 57–62, 1899.

Exhibit: Adult and figure.

THE TARNISHED PLANT-BUG.

Lygus pratensis Linn.

For general account see Riley, Rpt. U. S. Dept. Agric. f. 1884, pp. 312–315, 1885.

Exhibit: Adult and figure.

THE SANDY GROUND BUG

Emblethis arenarius Linn.

Exhibit: Adult.

PURSLANE BUG.

Geocoris bullatus Say.

Exhibit: Adult.

THE MILITARY BUG.

Hadronema militaris Uhl.

Exhibit: Adult.

CLOUDED PIGWEED BUG.

Sphragisticus nebulosus Fall.

Exhibit: Adult.

THE BROWN LEAF-HOPPER.

Agallia sanguinolenta Prov.

Exhibit: Adult.

THE CHINCH-BUG.

Blissus leucopterus Say.

For general article and life history see Webster, Bul. 15, n. s., Div. Ent., U. S. Dept. Agric., 82 pp. 1898.

Exhibit: Eggs, nymph, adult, and figure.

THE FALSE CHINCH-BUG.

Nysius angustatus Uhl.

(Attacks many garden crops.)

Exhibt: Adult and figure.

HOODED PLANT-BUG.

Euthoctha galeator Fab.

Exhibit: Eggs, nymph, and adult.

THE IMBRICATED SNOUT-BEETLE.

Epicærus imbricatus Say.

For detailed account see Chittenden, Bul. 19, n. s., Div. Ent., U. Dept. Agric., pp. 62–67, 1899.

Exhibit: Adult and figure.

THE GIBBOUS JUNE BEETLE.

Lachnosterna gibbosa Burm.

For general account of white grub see Forbes, 18th Rpt. St. Ent. Ill., pp. 109–144, 1894.

Exhibit: Adult and figure.

THE 12-SPOTTED CUCUMBER BEETLE.

Diabrotica duodecempunctata Ol.

For general account and remedies see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 12–13, 1903; Quaintance, Bul. 26, n. s., pp. 35–40, 1900.

Exhibit: Adult, figures, and parasite *Celatoria diabroticæ.*

MONOCREPIDIUS VESPERTINUS Fab.

Exhibit: Adult and figure.

PENCILED SNOUT-BEETLE.

Centrinus penicellus Hbst.

Exhibit: Adult.

THE GREATER SUGAR-BEET LEAF-BEETLE.

Monoxia puncticollis Say.

Exhibit: Adult and figure.

THE LESSER SUGAR-BEET LEAF-BEETLE.

Monoxia consputa Lec.

Exhibit: Adult and figure.

THE GRAPE-VINE COLASPIS.

Colaspis brunnea Fab.

For general article see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 13–14, 1903.

Exhibit: Adult and figure.

WHITE GRUB; MAY BEETLE.

Lachnosterna fusca Fröh.

For account of white grubs injuring corn see Forbes, 18th Rpt. St. Ent. Ill., pp. 109–145, 1894.

Exhibit: Adult and figure.

THE CONVEX FLEA-BEETLE.

Psylliodes convexior Lec.

Exhibit: Adult.

THE PALE-STRIPED FLEA-BEETLE.

Systena blanda Mels.

For general articles see Chittenden, Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 22–29, 1900; Bul. 43, Div. Ent., p. 16, 1903.

Exhibit: Adult and figure.

THE SPINACH FLEA-BEETLE.

Disonycha xanthomelæna Dalm.

Exhibit: Adult, figure, and parasite *Hypostena barbata* Coq.

THE WAVY-NECKED FLEA-BEETLE.

Disonycha crenicollis Say.

Exhibit: Adult.

THE TRIANGULAR FLEA-BEETLE.

Disonycha triangularis Say.

Exhibit: Adult.

THE CUCUMBER FLEA-BEETLE.

Epitrix cucumeris Harr.

For short account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 89–90, 1899.

Exhibit: Adult and figure.

THE TOOTHED FLEA-BEETLE.

Chætocnema denticulata Illig.

Exhibit: Adult.

THE ASH-GRAY BLISTER-BEETLE.

Macrobasis unicolor Kby.

For short article see Chittenden, Yearbook, U. S. Dept. Agric., f. 1898, pp. 249–250, 1899.

Exhibit: Adult.

THE SPOTTED BLISTER-BEETLE.

Epicauta maculata Say.

For general account see Saunders, Bul. 57, S. Dak. Agric. Expt. Sta., p. 52, 1898; Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 24–25, 1903.

Exhibit: Adult and figure.

THE GRAY BLISTER-BEETLE.

Epicauta cinerea Först.

For brief account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 25, 1903.

Exhibit: Adult and figure.

BLACK BLISTER-BEETLE.

Epicauta pennsylvanica DeG.

For brief account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 25, 1903.

Exhibit: Adult and figure.

THE STRIPED BLISTER-BEETLE.

Epicauta vittata Fabr.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Agric., pp. 22–23, 1903.

Exhibit: Adult and figure.

NUTTALL'S BLISTER-BEETLE.

Cantharis nuttalli Say.

For short article see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 27, 1903.

Exhibit: Adult and figure.

INSECTS INJURIOUS TO TOBACCO.

For general articles see Howard, Farmers' Bul. 120, U. S. Dept. Agric., 1900; Yearbook, 1898, pp. 120–150.

NORTHERN TOBACCO WORM; TOMATO WORM.

Phlegethontius quinquemaculata Haw.

(Formerly *Protoparce celeus.*)

For general account see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 10–14, 1900.

Exhibit: Larva, pupa, adult, and figure.

SOUTHERN TOBACCO WORM; HORNBLOWER.

Phlegethontius sexta Joh.

(Formerly *Protoparce carolina.*)

For general account see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 10–14, 1900; Alwood, Bul. 17, n. s., Div. Ent., U, S, Dept. Agric., pp. 72–74, 1898.

Exhibit: Larva, pupa, adult, and figure.

TOBACCO BUDWORM.

Chloridea virescens Fab.

(Formerly *Heliothis rhexiæ* S. & A.)

For general account see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 14–16, 1900.

Exhibit: Pupa, adult, and figure.

THE VARIEGATED CUTWORM.

Peridroma saucia Hübn.

For general bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 46–64, 1901.

Exhibit: Adult and figure.

THE BLACK CUTWORM.

Agrotis ypsilon Rott.

For general account see Riley, Rpt. U. S. Dept. Agric. f. 1884, pp. 294–295, 1885.

Exhibit: Adult and figure.

CORN-EAR WORM; COTTON BOLLWORM.

Heliothis obscura Fab.

(Feeds also on tobacco and tomato. For special case illustrating life history see under cotton and corn exhibits.)

For life history and general account see Quaintance, Farmers' Bul., 191, U. S. Dept. Agric., 1904.

Exhibit: Larva, pupa, adult, and figure.

GRANULATED CUTWORM.

Feltia annexa Tr.

For general account see Riley, Rpt. U. S. Dept. Agric. 1884, pp. 291–292, 1885. For description of stages see French, Canad. Ent., v. XIV, pp. 207–210, 1882.

Exhibit: Adult and figure.

THE PRETTY CUTWORM.

Mamestra legitima Grt.

For brief account see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 24–25, fig. 20, 1900.

Exhibit: Larva, pupa, adult, and figure.

THE COMMELINA OWLET MOTH.

Prodenia commelinæ S. & A.

For life history and general account see Chittenden, Bul. 27, n. s., Div. Ent. U. S. Dept. Agric., pp. 59–64, pl. iv, fig. 1, 1901.

Exhibit: Larva, adult, and figure.

THE CABBAGE LOOPER.

Autographa brassicæ Riley.

For general account and life history see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 60–69, 1902.

Exhibit: Adult and figure.

ŒCANTHUS QUADRIMACULATUS Beut.

For brief notice as *Œ. fasciatus* see Howard, Farmers' Bul. 120, U. S. Dept. Agric., p. 25, 1900.

Exhibit: Adult.

TOBACCO SUCKFLY.

Dicyphus minimus Uhl.

For general account see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 16–18, 1900.

Exhibit: Adult and figure.

TOBACCO SPLITWORM; POTATO-TUBER WORM.

Phthorimæa operculella Zell.

(Works in leaves and stems. Formerly *Gelechia solanella.*)

For general accounts see Riley and Howard, Insect Life, v. IV, pp. 239–242, 1892; Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 19–22, 1900.

Exhibit: Adult and figure.

THE TOBACCO FLEA-BEETLE.

Epitrix parvula Fab.

For general account and life history see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 85–87, 1899; Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 5–10, 1900.

Exhibit: Adult and figure.

THE TOBACCO STALK WEEVIL.

Trichobaris mucorea Lec.

For general account see Chittenden, Bul. 38, Div. Ent., U. S. Dept. Agric., pp. 66–70, 1902.

Exhibit: Cocoon, adult, and work.

EUSCHISTUS VARIOLARIUS Beauv.

For brief accounts see Garman, Bul. 66, Ky. Agr. Exp. Sta., pp. 33–34, 1897; Howard, Farmer's Bul. 120, U. S. Dept. Agric., pp. 18–19, 1900.

Exhibit: Adult.

THE TOBACCO THRIPS.

Thrips tabaci Lind.

For brief account see Howard, Farmer's Bul. 120, U. S. Dept. Agric., pp. 24–25, 1900.

Exhibit: Figure.

THE CIGARETTE BEETLE.

Lasioderma testaceum Dufts.

(Formerly *L. serricorne.*)

For general account see Chittenden, Bul. 4, n. s., revis. ed., Div. Ent., U. S. Dept. Agric., pp. 126–127, 1897.

Exhibit: Adult, work, and figure.

THE DRUG-STORE BEETLE.

Sitodrepa panicea Linn.

For general account see Chittenden, Bul. 4, n. s., revis. ed., Div. Ent., U. S. Dept. Agric., pp. 124–126, 1897.

Exhibit: Adult and figure.

INSECTS INJURIOUS TO BEANS AND PEAS.

THE LIMA-BEAN STEM-BORER.

Monoptilota nubilella Hulst.

(Bores in stalks of Lima beans.)

For life history and general account see Chittenden. Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 9–17, 1900.

Exhibit: Larva, cocoon, adult, work, and figure.

SMALLER CORN STALK-BORER.

Elasmopalpus lignosellus Zell.

For life history and general account see Chittenden. Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 17–22, 1900.

Exhibit: Larva, adult, and figure.

NUTTALL'S BLISTER BEETLE.

Cantharis nuttalli Say.

For short article see Chittenden. Bul. 43. Div. Ent., U. S. Dept. Agric., p. 27, 1903.

Exhibit: Adult and figure.

THE ASH-GRAY BLISTER BEETLE.

Macrobasis unicolor Kby.

For short article see Chittenden, Yearbook, U. S. Dept. Agric., f. 1898, pp. 249–250, 1899.

Exhibit: Adult.

THE BEAN LEAF-BEETLE.

Cerotoma trifurcata Först.

(Formerly *C. caminea* Fab.)

For general account see Chittenden, Yearbook, U. S. Dept. Agric. 1898, pp. 253–254.

Exhibit: Adult and figure.

THE BEAN LADYBIRD.

Epilachna corrupta Muls.

For general account see Gillette, Bul. 47, Colorado Agr. Expt. Sta., pp. 41–43, 1898; Chittenden, Yearbook, U. S. Dept. Agric., f. 1898, pp. 251–253, 1899.

Exhibit: Adult and figure.

THE 12-SPOTTED CUCUMBER BEETLE.

Diabrotica duodecempunctata Ol.

For general accounts and remedies see Quaintance, Bul. 26, n. s., Div. Ent., U. S. Dept. Agric., pp. 35–40, 1900; Chittenden, Bul. 43, pp. 12–13, 1903.

Exhibit: Adult.

THE IMBRICATED SNOUT-BEETLE.

Epicærus imbricatus Say.

For detailed account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 62–67, 1899; for general account, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 28–29, 1903.

Exhibit: Adult.

THE BANDED FLEA-BEETLE.

Systena tæniata Say.

For short account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 17, 1903.

Exhibit: Adult.

THE PALE-STRIPED FLEA-BEETLE.

Systena blanda Melsh.

For general article see Chittenden, Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 22–29, 1900; Bul. 43, p. 16, 1903.

Exhibit: Adult and figure.

THE LEAF-MINING LOCUST BEETLE.

Odontota dorsalis Thunb.

(Lives on locust, but attacks beans and other leguminous plants.)

For full life history, bibliography, and distribution see Chittenden, Bul. 38, Div. Ent., U. S. Dept. Agric., pp. 70-73, 1902.

Exhibit: Adult and figure.

THE DISTENDED MAY BEETLE.

Lachnosterna farcta Lec.

For short notices see Comstock, Rpt. U. S. Dept. Agric., 1879, pp. 247–248, Pl. V, fig. 5, 1880; Howard, Bul. 22, n. s., Div. Ent., U. S. Dept. Agric., p. 107, 1900.

Exhibit: Adult.

THE GARDEN FLEA-HOPPER.

Halticus uhleri Giard.

For general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 57-62, 1899.

Exhibit: Adult and figure.

THE DINGY CUTWORM.

Feltia subgothica Haw.

For brief account see Chittenden, Yearbook, U. S. Dept. Agric., f. 1898, p. 257, 1899.

Exhibit: Adult.

SALT-MARSH CATERPILLAR.

Estigmene acræa Dru.

(Formerly *Leucarctia.*)

For short account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 43–44, fig. 41, 1903.

Exhibit: Adult.

YELLOW-BEAR CATERPILLAR.

Diacrisia virginica Fab.

(Formerly *Spilosoma.*)

For general account see Lugger, 4th Rpt. State Ent. Minn., pp. 79–81, fig. 78, 1899.

Exhibit: Adult and figure.

THE BEAN CUTWORM.

Ogdoconta cinereola Guen.

(Feeds on buds and leaves.)

For life history and general account see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 98–100, 1902.

Exhibit: Adult and figure.

THE ROLLER WORM.

Eudamus proteus Linn.

(Feeds on buds and leaves.)

For general article and life history see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 92–96, 1902.

Exhibit: Larva, chrysalis, adult, and figure.

COMMON BEAN WEEVIL.

Bruchus obtectus Say.

For general account and life history see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 239–242.

Exhibit: Adult, work, and figure.

THE PEA WEEVIL.

Bruchus pisorum Linn.

For general account and life history see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 234–239.

Exhibit: Adult, work, and figure.

THE COWPEA WEEVIL.

Bruchus chinensis Linn.

For general account and life history see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 242–245.

Exhibit: Adult and figure.

FOUR-SPOTTED BEAN-WEEVIL.

Bruchus quadrimaculatus Boh.

For general account and life history see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 245–247.

Exhibit: Adult and figure.

THE LENTIL WEEVIL.

Bruchus lentis Boh.

For brief account see Chittenden, Yearbook, U. S. Dept. Agric., 1898, p. 248.

Exhibit: Adult.

EUROPEAN BEAN-WEEVIL.

Bruchus rufimanus Boh.

For general account see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 247–248.

Exhibit: Adult.

THE MEXICAN BEAN-WEEVIL.

Spermophagus pectoralis Shp.

For brief account see Chittenden, Yearbook, U. S. Dept. Agric., 1898, p. 248.

Exhibit: Adult and figure.

THE GRAY HAIR-STREAK.

Uranotes melinus Hübn.

(Works in pods of peas and beans, and in silk corn. Formerly *Thecla.*)

For brief article see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 101–102, 1902.

Exhibit: Larva, pupa, adult, and figure.

BOLLWORM; CORN-EAR WORM.

Heliothis obscura Fab.

(See special case for full life history with illustrations.)

For life history and general account see Quaintance, Farmers' Bul. 191, U. S. Dept. Agric., 1904.

Exhibit: Larva, adult, work, and figure.

THE IMPORTED PEA-MOTH.

Semasia nigricana Steph.

For general accounts and life history see Fletcher, Rpt. Ent. and Bot., Can. Dept. Agric., 1900, p. 214, 1901; Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 96–98, 1902.

EXHIBIT: Adult and figure.

INSECTS INJURIOUS TO CRUCIFERS.

IMPORTED CABBAGE-WORM.

Pontia rapæ Sch.

(Formerly *Pieris.*)

For general articles see Riley, Rpt. U. S. Dept. Agric., f., 1883, pp. 108–113, 1884; Lugger, 1st Rpt. St. Ent. Minn., pp. 71–77, Pl. VI, 1896.

EXHIBIT: Larva, chrysalis, and adult.

THE LARGE CABBAGE BUTTERFLY.

Pontia monuste Linn.

For general article see Riley, Rpt. U. S. Dept. Agric., 1883, pp. 117–118, 1884. (Formerly *Pieris.*)

EXHIBIT: Adult.

THE POT-HERB BUTTERFLY.

Pontia oleracea Boisd.

(Formerly *Pieris.*)

For general account see Riley, Rpt. U. S. Dept. Agric., 1883, pp. 115–117, 1884.

EXHIBIT: Chrysalis and adult.

THE SOUTHERN CABBAGE WORM.

Pontia protodice Boisd.

For general articles see Riley, Rpt. U. S. Dept. Agric., f., 1883, pp. 114–115, 1884; Lugger, 1st Rpt. St. Ent. Minn., pp. 71–77, Pl. VII, 1896. (Formerly *Pieris.*)

EXHIBIT: Chrysalis and adult.

GARDEN WEB-WORM.

Loxostege similalis Guen.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 39–40, 1903.

EXHIBIT: Adult and figure.

GRANULATED CUTWORM.

Feltia annexa Tr.

For description of eggs and larval stage see French, Can. Ent., v. XIV, pp. 207–210, 1882. For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 291–292, 1885.

EXHIBIT: Larva, pupa, adult, and figure.

THE STRIPED CUTWORM.

Feltia subgothica Haw.

For general account see Slingerland, Bul. 104, Cornell Univ. Agric. Expt. Sta., pp. 274–279, 1895.

Exhibit: Larva, adult, and figure.

SHAGREENED CUTWORM.

Feltia malefida Guen.

(Larvæ destroy young plants.)

For short account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 292–293, 1885.

Exhibit: Adult and figure.

THE VARIEGATED CUTWORM.

Peridroma saucia Hübn.

For general bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 46–64, 1902.

Exhibit: Larva, adult, and figure.

THE BLACK CUTWORM.

Agrotis ypsilon Rott.

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 294–295, 1885.

Exhibit: Larva, adult, and figure.

THE SPECKLED CUTWORM.

Mamestra subjuncta G. & R.

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, p. 296, 1885.

Exhibit: Larva, pupa, and adult.

THE GLASSY CUTWORM.

Hadena devastatrix Brace.

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 296–297, 1885.

Exhibit: Adult.

THE W-MARKED CUTWORM.

Noctua clandestina Harr.

For general account see Slingerland, Bul. 104, Cornell Univ. Agr. Expt. Sta., pp. 571–574, 1895.

Exhibit; Larva and adult.

FALL ARMY WORM.

Laphygma frugiperda S. & A.

For full bibliography and life history see Chittenden, Bul. 29, n. s., Div. Ent., U. S. Dept. Agric., pp. 40–45, 1901.

Exhibit: Larva, adult, and figure.

THE CROSS-STRIPED CABBAGE WORM.

Evergestis rimosalis Guen.

(Formerly *Pionea.*)

For general article see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 54–59, 1902.

Exhibit: Larva, pupa, cocoon, adult, and figure.

THE SALT-MARSH CATERPILLAR.

Estigmene acræa Dru.

(Formerly *Leucarctia.*)

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 43–44, 1903.

Exhibit: Larva, cocoon, and adult.

THE CABBAGE LOOPER.

Autographa brassicæ Riley.

For general account and life history see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 60–69, 1902. (Formerly *Plusia.*)

Exhibit: Larva, cocoon, pupa, and adult.

THE DIAMOND-BACK MOTH.

Plutella maculipennis Curtis.

(Formerly *P. cruciferarum.*)

For general account see Lugger, 1st. Rpt. St. Ent. Minn., p. 79, Pl. VI, 1896.

Exhibit: Larva, cocoon, adult, and work.

HARLEQUIN CABBAGE-BUG.

Murgantia histrionica Hahn.

(Feeds on cruciferous plants of all kinds.)

For general accounts see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 309–312, 1885; Smith, Bul. 121, N. J. Agr. Expt. Sta., pp. 3–6, 1897.

Exhibit: Eggs, nymph, and adult.

THE TARNISHED PLANT-BUG.

Lygus pratensis Linn.

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 312–315, 1885.

Exhibit: Adult.

THE EGG-PLANT FLEA-BEETLE.

Epitrix fuscula Cr.

For general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 87–89, 1899.

Exhibit: Adult and figure.

THE RED TURNIP BEETLE.

Entomoscelis adonidis Pallas.

For partial life history, short accounts, and bibliography see Fletcher, Rpt. Ent. and Bot.; Can. Dept. Agr., 1892, pp. 152–155, 1893; loc. cit., 1900, pp. 241, 1901; Chittenden, Bull. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 49–53, 1902.

EXHIBIT: Figure.

WESTERN CABBAGE FLEA-BEETLE.

Phyllotreta albionica Lec.

EXHIBIT: Adult.

HORSE-RADISH FLEA-BEETLE.

Phyllotreta armoraciæ Koch.

For general accounts see Chittenden, Ins. Life, v. VII, pp. 404–406, 1895; Bul. 9, n. s., Div. Ent., U. S. Dept. Agric., pp. 21–22, 1897.

EXHIBIT: Adult.

THE WESTERN FLEA-BEETLE.

Phyllotreta pusilla Horn.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 18–19, 1903.

EXHIBIT: Adult and figure.

THE STRIPED FLEA-BEETLE.

Phyllotreta vittata Fab.

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 301–304, 1885.

EXHIBIT: Adult.

WAVY-STRIPED FLEA-BEETLE.

Phyllotreta sinuata Steph.

(Formerly *P. zimmermani.*)

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 304–308, 1885.

EXHIBIT: Adult.

THE CAULIFLOWER PYRALID.

Pachyzancla bipunctalis Fab.

(Formerly *Botis repetitalis.*)

For description and brief accounts see Comstock, Rpt. U. S. Dept. Agric., 1880, p. 270, 1881; Riley, Rpt. U. S. Dept. Agric., 1883, pp. 128–129, 1884.

EXHIBIT: Pupa and adult.

THE ZEBRA CATERPILLAR.

Mamestra picta Harr.

For bibliography and general life-history see Felt, 14th Rpt. N. Y. St. Ent., pp. 201–207, 1898.

EXHIBIT: Larva, pupa and adult.

THE CABBAGE MAGGOT.

Pegomya brassicæ Bouché.

(Formerly *Anthomyia.*)

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 319–321, 1885.

Exhibit: Adult.

THE CABBAGE PLANT-LOUSE.

Aphis brassicæ Linn.

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 317–319, 1885.

Exhibit: Adult and work.

IMPORTED CABBAGE WEBWORM.

Hellula undalis Fab.

For general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 51–57, 1899.

Exhibit: Larva, pupa, adult and figure.

THE CABBAGE CURCULIO.

Ceutorhynchus rapæ Gyll.

For general account and partial life history see Chittenden, Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 39–50, 1900.

Exhibit: Adult and figure.

THE IMPORTED CABBAGE LEAF-MINER.

Scaptomyza graminum Fall.

(Formerly *Oscinis brassicæ.*)

See Riley, Rpt. U. S. Dept. Agric., 1884, p. 322, 1885. For short account see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 76–77, 1902.

Exhibit: Adult.

INSECTS INJURIOUS TO POTATO.

THE RINGED MILLIPEDE.

Cambala annulata Say.

Exhibit: Figure.

THE SHORT-WINGED MOLE-CRICKET.

Scapteriscus abbreviatus Scudd.

For general account see Chittenden, Bul. 40, Div. Ent., U. S. Dept. Agric., pp. 117–118, 1903. For account of an allied species *S. didactylus* Latr., see Barrett, Bul. 2, Porto Rico Agric. Expt. Sta., 1902.

Exhibit: Adult.

POTATO-TUBER WORM; TOBACCO SPLIT-WORM.

Phthorimæa operculella Zell.

(Formerly *Lita* and *Gelechia solanella*. Works in stems and tubers.) For general account see Riley and Howard, Insect Life, v. IV, pp. 239–242, 1892; Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 19–22, 1900.

Exhibit: Adult and figure.

THE POTATO-STALK WEEVIL.

Trichobaris trinotata Say.

For life history and general account see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 9–19, 1902.

Exhibit: Adult and work.

STALK-BORER.

Papaipema nitela Guen.

(Formerly *Gortyna* and *Hydræcia*. Bores in stems of various plants.) For general account see Bird, Can. Ent., v. XXX, pp. 127–128, 1898.

Exhibit: Adult.

THE LITTLE GREEN TORTOISE-BEETLE.

Cassida pallidula Boh.

(Formerly *C. texana*.)

For short account see Riley, Amer. Nat., v. 17, p. 1070, October [17 Sept.], 1883.

Exhibit: Adult.

THE GOLDEN TORTOISE-BEETLE.

Coptocycla bicolor Fab.

(Formerly *C. aurichalcea*.)

For general account see Sanderson, Bul. 59, Md. Agr. Expt. Sta., pp. 139–140, 1899.

Exhibit: Adult.

COLORADO POTATO-BEETLE.

Leptinotarsa decemlineata Say.

(Formerly *Doryphora*.)

For general account of life history see Smith, Rpt. N. J. Agric. Expt. Sta., 1895, pp. 452–458, 1896.

Exhibit: Egg, larva, pupa, adult, figure, and the following enemies: *Brachinus kansanus* Lec., *Chilocorus bivulnerus* Mels., *Coccinella sanguinea* Linn., *Coccinella novemnotata* Hbst., *Harpalus caliginosus* Fab., *Hippodamia convergens* Gúer., *Hippodamia glacialis* Fab., *Lebia atriventris* Say, *Lebia grandis* Htz., *Megilla maculata* DeG., *Nezara hilaris* Say, *Pasimachus elongatus* Lec., *Podisus spinosus* Dall., *Polistes pallipes* Lep., and *Tetracha virginica* Linn.

BOGUS POTATO-BEETLE.

Leptinotarsa juncta Germ.

(This species exhibited merely on account of similarity to preceding species. It feeds on wild Solanums.)

EXHIBIT: Adult.

THREE-LINED POTATO-BEETLE.

Lema trilineata Oliv.

For general account see Riley, 1st. Rpt. St. Ent. Mo., pp. 99–100, 1869.

EXHIBIT: Adult and figure.

THE WHITE BLISTER-BEETLE.

Macrobasis albida Say.

For brief account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 26, 1903.

EXHIBIT: Adult.

THE ASH-GRAY BLISTER-BEETLE.

Macrobasis unicolor Kby.

For general account see Chittenden, Yearbook, U. S. Dept. Agric., 1898, pp. 249–250.

EXHIBIT: Adult.

THE STRIPED BLISTER-BEETLE.

Epicauta vittata Fab.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 22–23, 1903.

EXHIBIT: Adult.

BLACK BLISTER-BEETLE.

Epicauta pennsylvanica DeG.

For brief account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 25, 1903.

EXHIBIT: Adult.

THE CROW BLISTER-BEETLE.

Epicauta corvina Lec.

For brief notice see Comstock, Rpt. U. S. Comm. Agric., 1879, p. 251, 1880.

EXHIBIT: Adult.

THE GRAY BLISTER-BEETLE.

Epicauta cinerea Först.

For brief account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., p. 24, 1903.

EXHIBIT: Adult.

THE SPOTTED BLISTER-BEETLE.

Epicauta maculata Say.

For general accounts see Saunders, Bul. 57, S. Dak. Agric. Expt. Sta., p. 52, 1898; Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 24–25, 1903.

Exhibit: Adult and figure.

THE EGG-PLANT FLEA-BEETLE.

Epitrix fuscula Cr.

For general account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 87–89, 1899.

Exhibit: Adult.

INSECTS INJURIOUS TO SWEET POTATOES.

For general bulletin see Sanderson, Sweet Potato Insects, Bul. 59, Md. Agric. Expt. Sta., 1900.

SWEET-POTATO ROOT-BORER.

Cylas formicarius Fab.

Exhibit: Adult and work.

SWEET-POTATO HAWK-MOTH.

Phlegethontius cingulata Fab.

Exhibit: Adult.

THE SWEET-POTATO PLUME-MOTH.

Pterophorus monodactylus Linn.

Exhibit: Adult.

LARGER SWEET-POTATO SAWFLY.

Schizocerus privatus Nort.

For general account see Marlatt, Insect Life, v. V, pp. 24–27, fig. 6, 1892.

Exhibit: Adult and figure.

SWEET-POTATO FLEA-BEETLE.

Chætocnema confinis Cr.

Exhibit: Adult.

THE CUCUMBER FLEA-BEETLE.

Epitrix cucumeris Harr.

For short account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 89–90, 1899.

Exhibit: Adult.

THE MOTTLED TORTOISE BEETLE.

Coptocycla signifera Hbst.

(Formerly *C. guttata.*)

Exhibit: Adult.

BLACK-LEGGED TORTOISE BEETLE.

Cassida nigripes Oliv.

Exhibit: Adult and work.

TWO-STRIPED TORTOISE BEETLE.

Cassida bivittata Say.

Exhibit: Adult.

THE GREEN TORTOISE BEETLE.

Physonota unipunctata Say.

For brief notices see Hamilton, Canad. Ent., v. XVI, pp. 134–135, 1884, and Caulfield, l. c., p. 227.

Exhibit: Adult.

THE ARGUS TORTOISE BEETLE.

Chelymorpha argus Licht.

(Also called *C. cassidea.*)

Exhibit: Adult.

INSECTS INJURIOUS TO TOMATO.

NORTHERN TOBACCO WORM; TOMATO WORM.

Phlegethontius quinquemaculata Haw.

(Formerly *Protoparce celeus.*)

For general account see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 10–14, 1900.

Exhibit: Larva and adult.

SOUTHERN TOBACCO WORM; HORNBLOWER.

Phlegethontius sexta Joh.

(Formerly *Protoparce carolina.*)

For general accounts see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 10–14, 1900; Alwood, Bul. 17, n. s., Div. Ent., U. S. Dept. Agric., pp. 72–74, 1898.

Exhibit: Larva and adult.

THE STALK BORER.

Papaipema nitela Guen.

For general accounts see Bird, Can. Ent., v. XXX, pp. 127–128, 1898; Lugger, 4th Rpt. State Ent. Minn., pp. 167–168, 1899.

Exhibit: Pupa and adult.

THE COMMELINA OWLET MOTH.

Prodenia commelinæ S. & A.

For life history and general account see Chittenden, Bull. 27, n. s., Div. Ent. U. S. Dept. Agric., pp. 59–64, Pl. IV, fig. 1, 1901.

Exhibit: Larva and adult.

CORN-EAR WORM; COTTON BOLLWORM.

Heliothis obscura Fab.

(Feeds also on tobacco and tomato; see under cotton and corn exhibits; formerly *H. armiger* Hübn.)

For life history and general account see Quaintance, Farmers' Bul. 191, 1904.

Exhibit: Larva and adult.

INSECTS INJURIOUS TO ASPARAGUS.

For general article on asparagus insects see Chittenden, Bul. 10, n. s., pp. 54–62, 1898.

THE ASPARAGUS MINER.

Agromyza simplex Loew.

For general account see Sirrine, Bul. 189, N. Y. Agric. Exp. Stat., pp. 277–282, 1900.

Exhibit: Adult.

LOPIDEA MEDIA Say.

Exhibit: Adult.

THE LESSER LOCUST.

Melanoplus atlanis Riley.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 178–183; pl. 12, fig. 7, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 26–27, 1891.

Exhibit: Adult.

THE TWO-STRIPED LOCUST.

Melanoplus bivittatus Say.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 363–368, pl. 24, fig. 5, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 31–32, 1891.

Exhibit: Adult and figure.

RED-LEGGED LOCUST.

Melanoplus femur-rubrum DeG.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 278–285, pl. 1, fig. h; pl. 19, figs. 1–4, 1897; Riley, Bul. 25, Div. Ent., U. S. Dept. Agric., pp. 27–28, 1891.

Exhibit: Adult.

MELANOPLUS PROPINQUUS Scudd.

For original description, see Scudder, Proc. U. S. N. M., v. XX; pp. 285–286, pl. 18, fig. 9, 1897.

Exhibit: Adult.

TWELVE-SPOTTED ASPARAGUS-BEETLE.

Crioceris duodecempunctata Linn.

For detailed account, see Chittenden, Yearbook, U. S. Dept. Agric., 1896, pp. 349–352, 1897.

Exhibit: Adult, figure, and adult of enemy, *Podisus spinosus* Dall.

THE ASPARAGUS BEETLE.

Crioceris asparagi Linn.

For detailed account, see Chittenden, Yearbook, U. S. Dept. Agric., 1896, pp. 341–349. For bibliography and general account, see Lintner, 11th Rpt. St. Ent. N. Y., pp. 177–188, 1896.

Exhibit: Larva, adult, figure, and enemy, *Stiretrus anchorago* Fab.

THE TWELVE-SPOTTED CUCUMBER BEETLE.

Diabrotica duodecempunctata Ol.

For general accounts and remedies, see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 12–13, 1903; Quaintance, Bul. 26, n. s., Div. Ent., U. S. Dept. Agric., pp. 35–40, 1900.

Exhibit: Adult and figure.

FALSE BUD-WORM; COTTON BOLLWORM.

Heliothis obscura Fab.

(Formerly *H. armiger* Hübn. For full life-history exhibit, see under cotton and corn.)

For life history and general account, see Quaintance, Farmers' Bul. 191, U. S. Dept. Agric., 1904.

Exhibit: Adult.

ZEBRA CATERPILLAR.

Mamestra picta Harr.

For general account see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 42–43, 1903.

Exhibit: Larva, adult, and figure.

THE PRETTY CUTWORM.

Mamestra legitima Grt.

For brief account see Howard, Farmers' Bul. 120, U. S. Dept. Agric., pp. 24–25, fig. 20, 1900.

Exhibit: Larva, adult, and figure.

CRANBERRY SPANWORM.

Cleora pampinaria Guen.

For general account see Smith, Farmers' Bul. 178, pp. 19–21, 1903.

Exhibit: Larva, pupa, and adult.

THE RED-BANDED LEAF-ROLLER.

Eulia triferana Walk.

(Formerly *Lophoderus.*)

For brief account see Lugger, 4th Rpt. State Entom. Minn. p. 231, 1899.

Exhibit: Larva, pupa, and adult.

THE SULPHUR-COLORED TORTRIX.

Epagoge sulfureana Clem.

(Formerly *Dichelia.*)

For brief account see Lugger, 4th Rpt. State Entom. Minn., pp. 232–233, 1899.

Exhibit: Pupa and adult.

INSECTS INJURIOUS TO CUCURBITS.

SQUASH-VINE BORER.

Melittia satyriniformis Hübn.

(Formerly *Ægeria cucurbitæ.*)

For life history and general accounts see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 34–40, 1899; Cir. 38, Div. Ent., U. S. Dept. Agric., 1899.

Exhibit: Larva, pupa, cocoon, adult, and figure.

PICKLE WORM.

Diaphania nitidalis Cram.

(Formerly *Eudioptis* and *Margaronia.*)

For general accounts and bibliography see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 40–42, 1899; Lintner, 11th Rpt. N. Y. St. Ent., pp. 126–133, 1896.

Exhibit: Pupa, cocoon, adult, and figure.

MELON CATERPILLAR.

Diaphania hyalinata Linn.

For general accounts and bibliography see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 42–44, 1899; Lintner, 11th Rpt. N. Y. St. Ent., pp. 134–138, 1896. (Formerly *Eudioptis* and *Margaronia.*

Exhibit: Larva, pupa, adult, and figure.

NORTHERN LEAF-FOOTED PLANT-BUG.

Leptoglossus oppositus Say.

For life history and general account see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 18–25, 1902.

Exhibit: Nymph, adult, and figure.

STRIPED CUCUMBER BEETLE.

Diabrotica vittata Fab.

For general accounts see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 48–51, 1899; Cir. 31, Div. Ent., U. S. Dept. Agric., 1898.

Exhibit: Adult, work, and figure.

TWELVE-SPOTTED CUCUMBER BEETLE.

Diabrotica duodecempunctata Oliv.

For general articles see Chittenden, Bul. 43, Div. Ent., U. S. Dept. Agric., pp. 12–13, 1903; Quaintance, Bul. 26, n. s., pp. 35–40, 1900.

Exhibit: Adult.

THE CUCUMBER FLEA-BEETLE.

Epitrix cucumeris Harr.

For short account see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 89–90, 1899.

Exhibit: Adult and figure.

THE PUNCTURED FLEA-BEETLE.

Psylliodes punctulata Mels.

For brief account see Forbes and Hart, 21st Rpt. St. Ent. Ill., p. 124, 1900.

Exhibit: Adult.

THE HORNED SQUASH-BUG.

Anasa armigera Say.

For general accounts see Chittenden, Can. Ent., v. XXX, pp. 239–240, 1898; Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 28–34, 1899.

Exhibit: Eggs, nymph, adult, and figure.

THE COMMON SQUASH-BUG.

Anasa tristis De G.

For general accounts see Chittenden, Cir. 39, Div. Ent., U. S. Dept. Agric., 1899; Bul. 19, n. s., pp. 20–28, 1899.

Exhibit: Eggs, nymph, adult, and figure.

THE SQUASH LADYBIRD.

Epilachna borealis Fab.

For bibliography and life history see Chittenden, Bul. 19, n. s., Div. Ent., U. S. Dept. Agric., pp. 11–20, 1899.

Exhibit: Larva, pupa, adult, and work.

INSECTS INJURIOUS TO OTHER VEGETABLE PRODUCTS.

INJURING CARROT, CELERY, PARSLEY, AND PARSNIP.

THE CELERY LOOPER.

Plusia simplex Guen.

For general account see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 73–74, 1902.

Exhibit: Adult and figure.

THE GREENHOUSE LEAF-TYER.

Phlyctaenia ferrugalis Hübn.

For detailed account (under *P. rubigalis* Guen.) see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 7–26, 1901.

Exhibit: Larva, cocoon, adult, and figure.

THE CELERY CATERPILLAR.

Papilio polyxenes Fab.

(Formerly *P. asterias.*)

For general account see Davis, Bul. 102, Mich. Agric. Expt. Sta., pp. 21-24, 1893.

Exhibit: Larva, adult and chrysalis.

THE CARROT RUST-FLY.

Psila rosæ Fab.

For general article see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 26–32, 1902.

Exhibit: Adult and figure.

THE CARROT BEETLE.

Ligyrus gibbosus DeG.

For general account see Chittenden, Bul. 33, n. s., Div. Ent., U. S. Dept. Agric., pp. 32–37, 1902.

Exhibit: Adult and figure.

THE PARSNIP WEBWORM.

Depressaria heracliana DeG.

For general accounts see Riley, Insect Life, v. I, pp. 94–98, 1888; Southwick, Insect Life, v. V, pp. 106–109, 1892.

Exhibit: Larva, pupa, adult, work, and figure.

THE PARSNIP LEAF-MINER.

Acidia fratria Loew.

(Formerly *Trypeta.*)

For short account see Coquillett Insect Life, v. VII, pp. 383–384, 1895.

Exhibit: Adult and figure.

THE PARSLEY ROOT-BORER.

Listronotus latiusculus Boh.

For brief notice of injury see Chittenden, Yearbook, U. S. Dept. Agric., 1902, p. 731.

Exhibit: Adult.

THE LITTLE NEGRO BUG.

Corimelæna pulicaria Germ.

For general account see Davis, Bul. 102, Mich. Agric. Expt. Sta., pp. 13–18, 1893.

Exhibit: Nymph and adult.

DARK-SIDED CUTWORM.

Euxoa messoria.

(Formerly *Carneades.*)

For general account see Riley, Rpt. U. S. Dept. Agric., 1884, pp. 290–291, pl. 2, fig. 6, 1885.

Exhibit: Adult and figure.

INJURIOUS TO ONION.

THE WHEAT WIREWORM.

Agriotes mancus Say.

For general account see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 77–78, 1901.

Exhibit: Adult and figure.

TOBACCO THRIPS; ONION THRIPS.

Thrips tabaci Lind.

For short accounts as *T. striatus* see Gillette, Bul. 47. Colo. Agric. Expt. Sta., p. 44, 1898; Howard, Farmers' Bul. 120, U. S. Dept. Agric. pp. 24–25, 1900.

Exhibit: Figure.

THE CORN-STALK MAGGOT.

Chætopsis ænea Wied.

For general account see Howard, Insect Life, v. VII, pp. 352–354, 1895.

Exhibit: Pupa and adult.

THE ONION FLY.

Pegomyia cepetorum Meade.

For general account as *Phorbia ceparum* see Slingerland, Bul. 78, Cornell Univ. Agric. Expt. Sta., pp. 495–496, 1894.

Exhibit: Adult.

INJURIOUS TO RHUBARB.

THE RHUBARB CURCULIO.

Lixus concavus Say.

For general account see Chittenden, Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 61–69, 1900.

Exhibit: Adult and figure.

THE CONVEX FLEA-BEETLE.

Psylliodes convexior Lec.

Exhibit: Adult.

INSECTS INJURIOUS TO ORNAMENTAL PLANTS.

For general article on insects affecting ornamental plants see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., 1901.

THE GREENHOUSE LEAF-TYER.

Phlyctænia ferrugalis Hübn.

Exhibit: Larva, cocoon, adult, and figure.

THE MORNING-GLORY LEAF-CUTTER.

Loxostege obliteralis Walk.

Exhibit: Larva, cocoon, adult, and figure.

THE ROSE BUD-WORM.

Olethreutes nimbatana Clem.

For bibliography and general account see Lintner, 5th Rpt. N. Y. St. Ent., pp. 213–215, 1889.

Exhibit: Pupa, adult, and figure.

THE VIOLET SAWFLY.

Emphytus canadensis Kby.

Exhibit: Adult and figure.

FULLER'S ROSE BEETLE.

Aramigus fulleri Horn.

Exhibit: Adult and figure.

THE FICKLE MIDGE.

Sciara inconstans Fitch.

Exhibit: Adult and figure.

THE VIOLET "GALL-FLY."

Diplosis violicola Coq.

Exhibit: Figure.

THE ROSE CURCULIO.

Rhynchites bicolor Fab.

Exhibit: Adult and figure.

CALIFORNIA FLOWER BEETLE.

Hoplia callipyge Lec.

EXHIBIT: Adult and figure.

THE ROSE LEAF-BEETLE.

Nodonota puncticollis Say.

For general account see Chittenden, Bull. 7, n. s., Div. Ent., U. S Dept. Agric., pp. 60–61, 1897.

EXHIBIT: Adult.

THE AZALEA BARK SCALE.

Eriococcus azaleæ Comst.

For bibliography, food plants and distribution, see Fernald, Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 72, 1903.

EXHIBIT: Infested twig.

THE EUONYMUS SCALE.

Chionaspis euonymi Comst.

For bibliography, food-plants, and distribution see Fernald, Coccidae of World, Bul. 88, Mass. Agr. Col., pp. 216, 1903.

EXHIBIT: Infested twig.

THE ROSE COTTONY SCALE.

Palæococcus rosæ R. & H.

For bibliography, distribution, and food plants, see Fernald, Coccidae of World, Bul. 88 Mass. Agr. Coll., p. 21, 1903. For general account see Riley and Howard, Insect Life, v. III, pp. 93–97, 1890.

EXHIBIT: Infested twig.

THE BLACK OR BROWN APHIS OF VIOLETS.

Rhopalosiphum violæ Perg.

For original description with short account of injury to violets, see Pergande, Can. Ent. v. XXXII, pp. 29–30, 1900.

EXHIBIT: Figure.

THE TWO-SPOTTED RED SPIDER.

Tetranychus bimaculatus Harv.

For description and distribution see Banks, Tech. Ser., 8, Div. Ent. U. S. Dept. Agric., pp. 73–74, 1900.

EXHIBIT: Figure.

THE WHITE ANT.

Leucotermes flavipes Koll.

For general account see Marlatt, Cir. 50, Div. Ent., U. S. Dept. Agric., 1902. (Formerly *Termes.*)

EXHIBIT: Adult and figure.

INSECTS INJURIOUS TO CRANBERRY.

For treatises on cranberry insects see Smith, Farmers' Bul. 178, U. S. Dept. Agric., 1903; Bul. 90 N. J. Agr. Exp. Sta., 1892; Saunders, Insects Injurious to Fruits, 2d ed., pp. 369–376, 1900.

INJURING THE LEAVES.

LEATHER-COLORED LOCUST.

Schistocerca alutacea Harr.

EXHIBIT: Adult. (Formerly *Acridium.*)

THE TWO-STRIPED LOCUST.

Melanoplus bivittatus Say.

For bibliography and general accounts see Scudder, Proc. U. S. N. M., v. XX, pp. 363–368, fig. 5, 1897; Riley, Bul. 25, Div. Ent. U. S. Dept. Agric., pp. 31–32, 1891.

EXHIBIT: Adult.

THE ANGULAR-WINGED KATYDID.

Microcentrum retinerve Burm.

EXHIBIT: Adult, eggs and parasitized eggs.

THE CRANBERRY LOOPER.

Xanthotype crocataria Fab.

(Formerly *Angerona.*)

For general account see Lugger, 4th Rpt. State Entom. Minn., pp. 178–179, 1899.

EXHIBIT: Adult.

CHAIN-SPOTTED GEOMETER.

Cingilia catenaria Dru.

(Formerly *Caterva.*)

For general account see Lugger, 4th Rpt. St. Ent. Minn., pp. 186–187, 1899; Packard, 5th Rpt. U. S. Ent. Comm., pp. 783–784, 1890.

EXHIBIT: Larva, pupa, and adult.

CRANBERRY SPANWORM.

Cleora pampinaria Guen.

(Formerly *Boarmia.*)

For general account see Smith, Farmers' Bul. 178, U. S. Dept. Agric., pp. 19–21, 1903.

EXHIBIT: Larva, pupa, and adult.

THE YELLOWHEAD CRANBERRY WORM.

Acleris minuta Rob.

(Formerly *Teras.*)

For general account see Smith, Farmers' Bul. 178, U. S. Dept. Agric., pp. 12–17, 1903.

EXHIBIT: Adult and figure.

THE VINE-WORM; THE FIRE-WORM.

Eudemis vacciniana Pack.

For general account see Smith, Farmers' Bul. 178, U. S. Dept. Agric., pp. 9–12, 1903.

Exhibit: Larva, adult, work, and figure.

INJURING THE STEMS.

THE CRANBERRY GIRDLER.

Crambus hortuellus Hübn.

For general account see Smith, Farmers' Bul. 178, U. S. Dept. Agric., pp. 21–24, 1903.

Exhibit: Adult and figure.

CRANBERRY SCALE; PUTNAM'S SCALE.

Aspidiotus ancylus Putn.

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 252–253, 1903.

Exhibit: Infested twig from fruit tree.

INSECTS INJURING THE FRUIT.

THE CRANBERRY FRUIT WORM.

Mineola vaccinii Riley.

For general account see Smith, Farmers' Bul. 178, U. S. Dept. Agric., pp. 24–26, 1903.

Exhibit: Pupa, cocoon, adult, and figure.

THE CRANBERRY KATYDID.

Scudderia texensis Sauss.

For general account see Smith, Farmers' Bul. 178, U. S. Dept. Agric., pp. 26–29, 1903.

Exhibit: Adult and figure.

INSECTS INJURIOUS TO STRAWBERRY.

For general articles treating of these insects see Forbes, 13th Rpt. Ill. St. Ent., pp. 60–180, 1884; Saunders, Insects Injurious to Fruits, 2d ed., pp. 321–335, 1900.

INJURING THE ROOTS AND CROWN.

THE STRAWBERRY CROWN-GIRDLER.

Otiorhynchus ovatus Linn.

For brief bibliography and account see Lintner, 10th Rpt. St. Ent. N. Y., pp. 416–419, 1895.

Exhibit: Adult.

THE STRAWBERRY CROWN-BORER.

Tyloderma fragariæ Riley.

For detailed accounts see Forbes, 12th Rpt. Ill. St. Ent., pp. 64–75, 1883; 13th Rpt., p. 142, 1884.

EXHIBIT: Adult, work, and figure.

STRAWBERRY CROWN MOTH.

Ægeria rutilans Hy. Edw.

(Formerly *Sesia.*)

For general account see Chittenden, Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 85–90, 1900.

EXHIBIT: Adult, pupa, and work.

THE SPOTTED STRAWBERRY LEAF-BEETLE.

Typophorus canellus Fab.

For general account see Forbes, 13th Rpt. St. Ent. Ill., pp. 159–163, 1884.

EXHIBIT: Adult.

INJURING THE ROOTS.

WHITE GRUB; JUNE BEETLE.

Lachnosterna arcuata Sm.

For general account see Chittenden, Bul. 27, n. s., Div. Ent., U. S. Dept. Agric., pp. 74–76, 1901.

EXHIBIT: Adult and figure.

THE STRAWBERRY ROOT-BORER.

Graphops nebulosus Lec.

For brief notice see Garman, Bul. 31, Ky. Agric. Exp. Sta., p. 23, 1890.

EXHIBIT: Adult.

INJURING THE LEAVES.

THE STRAWBERRY FALSE-WORM.

Harpiphorus maculatus Nort.

For general account see Harrington, Insect Life, v. II, pp. 227–228, 1890.

EXHIBIT: Larva, pupa, adult, work, and figure.

THE STRAWBERRY LEAF-CHAFER.

Diplotaxis frondicola Say.

For brief account see Kridelbaugh, Ann. Rpt. Ia. St. Hort. Soc., 1871, p. 161, 1872.

EXHIBIT: Adult and work.

THE STRAWBERRY FLEA-BEETLE.

Haltica ignita Illig.

For general account see Chittenden, Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 70–78, 1900.

EXHIBIT: Adult.

THE ROSE LEAF-BEETLE.

Nodonota puncticollis Say.

For general account see Chittenden, Bul. 7, n. s., Div. Ent., U. S. Dept. Agric., pp. 60–61, 1897.

Exhibit: Adult.

THE DUSKY PLANT-BUG.

Calocoris rapidus Say.

For short account see Lugger, 1st Rpt. St. Ent. Minn., p. 65, 1900.

Exhibit: Adult.

RASPBERRY LEAF-ROLLER.

Exartema permundana Clem.

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 312–313, 1890.

Exhibit: Adult.

THE STRAWBERRY LEAF-ROLLER.

Ancylis comptana Fröhl.

(Formerly *Phoxopteris.*)

For general account see Smith, Bul. 149, N. J. Agric. Expt. Sta., pp. 3–12, 1901.

Exhibit: Larva, pupa, adult, and figure.

THE SMEARED DAGGER.

Apatela oblinita S. & A.

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 567–568, 1890. (Formerly *Acronycta.*)

Exhibit: Larva, adult, and figure.

INJURING THE BUDS AND STEMS.

THE STRAWBERRY WEEVIL.

Anthonomus signatus Say.

(Lays eggs in buds and severs stems.)

For general account see Chittenden, Cir. 21, Div. Ent., U. S. Dept. Agric., 1897.

Exhibit: Adult, work, figure, and the parasites *Calyptus tibiator* Cr. and *Catolaccus incertus* Ashm.

INSECTS INJURIOUS TO BLACKBERRY AND RASPBERRY.

For general articles see Webster, Bul. 45, Ohio Agric. Expt. Sta., pp. 151–217, 1893; Saunders, Insects Injurious to Fruits, 2d edit., pp. 303–320, 1900.

INJURING THE ROOTS.

THE RASPBERRY ROOT-BORER

Bembecia marginata Harr.

For general account see Smith, Spec. Bul. N, N. J. Agric. Expt. Sta., pp. 9–12, 1891.

Exhibit: Larva and adult.

INJURING THE STEMS.

BLACKBERRY GALL-MAKER.

Diastrophus turgidus Bass.

(Formerly *D. nebulosus* O. S.)

For brief article see Saunders, Insects Injurious to Fruits, 2d ed., pp. 318–319, 1900.

Exhibit: Adult and figure.

RASPBERRY CANE-BORER.

Oberea bimaculata Oliv.

For bibliography and general account see Lintner, 5th Rpt. N. Y. St. Ent., pp. 231–233, 1889.

Exhibit: Adult and work.

THE SNOWY TREE-CRICKET.

Œcanthus niveus DeG.

For general account see Lugger; 3d Rpt. St. Ent. Minn., pp. 269–271, 1898.

Exhibit: Adult, work, and figure.

RED-NECKED CANE-BORER.

Agrilus ruficollis Fab.

For general account see Smith, Spec. Bul. N, N. J. Agric. Expt. Sta., pp. 4–8, 1891.

Exhibit: Adult, work, and figure.

INJURING THE LEAVES.

THE RASPBERRY SAWFLY.

Monophadnoides rubi Harris.

For bibliography and general account see Lowe. Bul. 150, N. Y. Agric. Expt. Sta., pp. 249–262, pls. IV–VI, 1898.

Exhibit: Larva, adult, and work.

RASPBERRY LEAF-ROLLER.

Exartema permundana Clem.

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 312–313, 1890.

Exhibit: Adult.

THE FALL WEBWORM.

Hyphantria cunea Dru.

(Feeds on leaves of various trees, shrubs, and vines.)

For general account see Howard, Farmers' Bul. 99, U. S. Dept. Agric., pp. 20–25, 1899.

Exhibit: Adult and figure.

THE SMEARED DAGGER.

Apatela oblinita S. & A.

For general account see Packard, 5th Rpt. U. S. Ent. Comm., pp. 567–568, 1890. (Formerly *Acronycta.*)

Exhibit: Larva and adult.

STRAWBERRY LEAF-ROLLER.

Ancylis comptana Fröhl.

(Formerly *Phoxopteris.*)

For general account see Smith, Bul. 149, N. J. Agric. Expt. Sta., pp. 3–12, 1901.

Exhibit: Pupa and adult.

THE FOUR-MARKED LEAF-BEETLE.

Cryptocephalus quadrimaculatus Say.

Exhibit: Adult.

THE HOODED PLANT-BUG.

Euthoctha galeator Fab.

For brief notices see Riley and Howard, Insect Life, v. I, p. 54, 1888; p. 366, 1889.

Exhibit: Eggs, nymph, and adult.

INJURING THE FRUIT.

RASPBERRY SPAN-WORM.

Synchlora ærata Fab.

(Formerly *S. glaucaria.*)

For bibliography and general account see Lintner, 8th Rpt. St. Ent. N. Y., pp. 129–133, 1893.

Exhibit: Pupa, adult, and figure.

THE LITTLE NEGRO BUG.

Corimelæna pulicaria Germ.

For general account see Lintner, 8th Rpt. St. Ent. N. Y., pp. 213–214, 1893.

Exhibit: Adult and figure.

INSECTS INJURIOUS TO CURRANT AND GOOSEBERRY.

For general article on insects affecting currant and gooseberry see Piper and Doane, Bul. 36, Washington Agr. Expt. Sta., 1898.

INJURING THE STEMS.

THE TERRAPIN SCALE.

Eulecanium nigrofasciatum Perg.

(Food plants: Apple, birch, linden, maple, peach, plum, sycamore; formerly *Lecanium.*)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., p. 191, 1903; Pergande, Bul. 18, n. s., Div. Ent., U. S. Dept. Agr., pp. 26–29, figs. 1898.

Exhibit: Infested twig.

THE NATIVE CURRANT STEM-BORER.

Psenocerus supernotatus Say.

For general account see Lugger, 5th Rpt. State Entom. of Minnesota, pp. 121–122, 1899.

Exhibit: Adult and work.

CURRANT CLEARWING MOTH; IMPORTED CURRANT-BORER.

Sesia tipuliformis Clerck.

For general account see Lugger, 4th Rpt. State Entom. Minn., pp. 60–64, 1899.

Exhibit: Adult and work.

PUTNAM'S SCALE; CRANBERRY SCALE.

Aspidiotus ancylus Putn.

(Food-plants: Apple, apricot, box-elder, cottonwood, cranberry, elm, hemlock, maple, oak, peach, pear, plum, etc.)

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 252–253, 1903.

Exhibit: Infested twig.

THE SAN JOSE SCALE.

Aspidiotus perniciosus Comst.

(Food plants: Almond, apple, apricot, birch, black walnut, black currant, catalpa, chestnut, crab apple, crab grass, cherry, grape, hickory, oak, peach, pear, persimmon, plum, poplar, prune, Rocky Mountain cherry, rose, silver maple, willow, and many other plants. See under "More important scale insects.")

For bibliography and food plants see Fernald, Cat. Coccidæ of World, Bul. 88, Mass. Agr. Coll., pp. 271–275, 1903; Howard and Marlatt, Bul. 3, n. s., Div. Ent., U. S. Dept. Agr., 1896. 80 pp.

Exhibit: Infested twig.

THE BLACK GOOSEBERRY BORER.

Xylocrius agassizii Lec.

For general accounts see Fletcher, Rpt. of Ent. and Bot. for 1898, Can. Dept. Agric., pp. 207–210, 1899; Chittenden, Bul. 23, n. s., Div. Ent., U. S. Dept. Agric., pp. 90–92, 1900.

Exhibit: Adult and figure.

INJURING THE LEAVES.

GOOSEBERRY SPANWORM.

Cymatophora ribearia Fitch.

For short account see Lugger, 4th Rpt. State Ent. Minn., pp. 184–186, 1899. (Formerly *Eufitchia.*)

Exhibit: Eggs, larva, pupa, adult, and figure.

IMPORTED CURRANT WORM.

Pteronus ribesii Scop.

(Formerly *Nematus ventricosus.*)

For bibliography and technical description see Marlatt, Tech. Series 3, Div. Entom., U. S. Dept. Agric., pp. 61–63, 1896.

EXHIBIT: Adult, figure, and an enemy, *Podisus placidus* Uhl.

THE NATIVE CURRANT WORM.

Pristiphora grossulariæ Walsh.

For bibliography see *Gymnonychus appendiculatus* Htg., Marlatt, Tech. Series 3, Div. Entom., U. S. Dept. Agric., p. 124, 1896.

EXHIBIT: Adult and figure..

THE CRANBERRY LOOPER.

Xanthotype crocataria Fab.

For general account see Lugger, 4th Rpt. State Entom. Minn., pp. 178–179, 1899.

EXHIBIT: Larva and adult.

POLYGONIA PROGNE Cram.

(Formerly *Grapta.*)

For general account see Packard, 5th Rpt. U. S. Entom. Comm., pp. 241, 1890.

EXHIBIT: Larva, chrysalis, and adult.

INJURING THE FRUIT.

GOOSEBERRY FRUIT-WORM.

Zophodia grossulariæ Pack.

For general account see Lugger, 4th Rpt. State Entom. Minn., pp. 214–216, 1899.

EXHIBIT: Pupa and adult.

INSECTS INJURIOUS TO STORED PRODUCTS.

(See also *Calandra oryza*, under Rice.)

THE WOLF MOTH.

Tinea granella Linn.

For general account see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., pp. 31–34, 1897.

EXHIBIT: Pupa and adult.

MEDITERRANEAN FLOUR MOTH.

Ephestia kuehniella Zell.

For general account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., pp. 8–9, 1897.

EXHIBIT: Larva, pupa, cocoon, adult, and figure.

DRIED-CURRANT MOTH.

Ephestia cautella Wlk.

For short account (under *E. cahiritella*) see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., pp. 7–9, 1897.

EXHIBIT: Larva, adult, and figure.

THE MEAL SNOUT-MOTH.

Pyralis farinalis Linn.

(Formerly *Asopia.*)

For short account see Chittenden, Farmers' Bul. 45, pp. 10–11, 1897.

EXHIBIT: Larva, pupa, cocoon, and adult.

THE INDIAN-MEAL MOTH.

Plodia interpunctella Hübn.

(Formerly *Ephestia.*)

For general account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., pp. 9–10, 1897.

EXHIBIT: Larva, pupa, adult, work, and figure.

ANGOUMOIS GRAIN-MOTH.

Sitotroga cerealella Oliv.

(Formerly *Gelechia.*)

For general account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., pp. 6–7, 1897.

EXHIBIT: Cocoon, adult, work, and figure.

THE FOREIGN GRAIN-BEETLE.

Cathartus advena Waltl.

For short account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., pp. 17–18, 1897.

EXHIBIT: Adult, work, and figure.

RED OR SQUARE-NECKED GRAIN-BEETLE.

Cathartus gemellatus Duv.

For short account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., p. 17, 1897.

EXHIBIT: Adult and figure.

THE SAW-TOOTHED GRAIN-BETTLE.

Silvanus surinamensis Linn.

For short account see Chittenden, Farmers' Bul. 45, U. S. Dept. Agric., pp. 16–17, 1897.

EXHIBIT: Adult and figure.

THE MERCHANT GRAIN-BEETLE.

Silvanus mercator Fauv.

For short account see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., p. 12, 1897.

EXHIBIT: Adult.

PHARAXONOTHA KIRSCHII Reitt.

For short notice see Chittenden, Insect Life, v. VII, p. 327, 1895.

Exhibit: Adult.

THE FLAT GRAIN-BEETLE.

Læmophlœus pusillus Sch.

For short account see Chittenden, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., p. 129, 1902.

Exhibit: Adult.

TYPHŒA FUMATA Linn.

Exhibit: Adult and work.

THE BLACK CARPET BEETLE.

Attagenus piceus Oliv.

For general account see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., pp. 15–19, 1897.

Exhibit: Adult.

TROGODERMA TARSALE Mels.

For general account see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., pp. 19–21, 1897.

Exhibit: Adult.

THE CABINET BEETLE.

Anthrenus verbasci Linn.

(Formerly *A. varius.*)

For short account see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., pp. 22–23, 1897.

Exhibit: Adult and work.

THE MEAL SAP-BEETLE.

Carpophilus dimidiatus Fab.

Exhibit: Adult.

THE CORN SAP-BEETLE.

Carpophilus pallipennis Say.

Exhibit: Adult.

THE CADELLE.

Tenebroides mauritanicus Linn.

(Formerly *Trogosita.*)

For general account see Chittenden, Farmers' Bul. 45, U. S. Dept Agric., pp. 18–19, 1897.

Exhibit: Larva, adult, work, and figure.

THE DARK MEAL-WORM.

Tenebrio obscurum Fab.

For short account see Chittenden, Farmers' Bul. 45, rev. ed., U. S. Dept. Agric., p. 15, 1897.

Exhibit: Larva, pupa, adult, and figure.

THE YELLOW MEAL-WORM.

Tenebrio molitor Linn.

For general account see Chittenden, Farmers' Bul. 45, rev. ed., U. S. Dept. Agric., pp. 14–15, 1897.

EXHIBIT: Larva, pupa, adult, and figure.

THE WHITE-MARKED SPIDER-BEETLE.

Ptinus fur Linn.

For general account see Chittenden, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., pp. 127–128, 1902.

EXHIBIT: Adult.

THE BROWN SPIDER-BEETLE.

Ptinus brunneus Dufts.

For short account see Chittenden, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., p. 128, 1902.

EXHIBIT: Adult.

THE DRUG-STORE BEETLE.

Sitodrepa panicea Linn.

(Listed as *Anobium* in foreign catalogues.)

For general account see Chittenden, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., pp. 124–126, 1897.

EXHIBIT: Adult, work and figure.

THE CIGARETTE BEETLE.

Lasioderma testaceum Dufts.

(Formerly *L. serricorne.*)

For general account see Chittenden, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., pp. 126–127, 1897.

EXHIBIT: Adult and figure.

THE LARGER GRAIN-BORER.

Dinoderus truncatus Horn.

For short account see Chittenden, Insect Life, v. VII, p. 327, 1895.

EXHIBIT: Adult.

THE RUST-RED FLOUR-BEETLE.

Tribolium ferrugineum Fab.

For general account see Chittenden, Farmers' Bul. 45, rev. ed., U. S. Dept. Agric., pp. 12–13, 1897.

EXHIBIT: Adult.

THE CONFUSED FLOUR-BEETLE.

Tribolium confusum Duv.

For general account see Chittenden, Bul. 4, n. s., rev. ed., Div. Ent. U. S. Dept. Agric., pp. 113–115, 1902.

EXHIBIT: Adult and figure.

THE SLENDER-HORNED FLOUR-BEETLE.

Echocerus maxillosus Fab.

For short account see Chittenden, Farmers' Bul. 45, rev. ed., U. S. Dept. Agric., p. 13, 1897.

Exhibit: Adult and figure.

THE BROAD-HORNED FLOUR-BEETLE.

Echocerus cornutus Fab.

For short account see Chittenden, Farmers' Bul. 45, rev. ed., U. S. Dept. Agric., p. 13, 1897.

Exhibit: Adult and figure.

THE SMALL-EYED FLOUR-BEETLE.

Palorus ratzeburgi Wissm.

For short account see Chittenden, Farmers' Bul. 45., rev. ed., U. S. Dept. Agric., pp. 13–14, 1897.

Exhibit: Adult and figure.

THE DEPRESSED FLOUR-BEETLE.

Palorus subdepressus Woll.

Exhibit: Adult.

ALPHITOBIUS PICEUS Ol.

Exhibit: Adult.

BROAD-NOSED GRAIN WEEVIL.

Caulophilus latinasus Say.

For general account see Chittenden, Bul. 8, n. s., Div. Ent., U. S. Dept. Agric., pp. 13–14, 1897.

Exhibit: Adult.

THE GRANARY WEEVIL.

Calandra granaria Linn.

(For an important enemy of stored grain, see *C. oryza*, under "Rice.")

For short account, see Chittenden, Farmers' Bul. 45, rev. ed., U. S. Dept. Agric., pp. 4–5, 1897.

Exhibit: Adult, work and figure.

BRACHYTARSUS ALTERNATUS Say.

For life history, notes, and general accounts, see Quaintance, Ent. News, pp. 1–3, plate, 1897.

Exhibit: Adult and figure.

HOUSEHOLD INSECTS.

For general account of household insects see Howard, Marlatt, and Chittenden, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., 1902. Contains articles on all the insects represented in the exhibit.

THE HOUSE CENTIPEDE.

Scutigera forceps Raf.

(While this animal is not an insect, but belongs to the class Myriapoda, it is so regularly associated with the insects that it may appropriately be presented with them. It feeds on flies, moths, roaches, etc.)

For general article see Marlatt, Cir. 48, Div. Ent., U. S. Dept. Agric., 1902.

Exhibit: Figure.

THE SILVER FISH.

Lepisma domestica Pack.

For general article see Marlatt, Cir. 49, Div. Ent., U. S. Dept. Agric., 1902.

Exhibit: Figure.

THE BOOK-LOUSE.

Troctes divinatoria Müll.

(Formerly *Psocus* and *Atropos.*)

Exhibit: Figure.

THE WHITE ANT.

Leucotermes flavipes Koll.

(Formerly *Termes.*)

For general account see Marlatt, Cir. 50, Div. Ent., U. S. Dept. Agric., 1902.

Exhibit: Adult and figure.

THE AMERICAN COCKROACH.

Periplaneta americana Linn.

For general article see Marlatt, Cir. 51, Div. Ent., U. S. Dept. Agric., pp. 1–8, 1902.

Exhibit: Adult and figure.

THE BLACK BEETLE.

Blatta orientalis Linn.

For general article see Marlatt, Cir. 51, Div. Ent., U. S. Dept. Agric., pp. 9–10, 1902.

Exhibit: Adult and figure.

THE CROTON BUG.

Blatella germanica Linn.

(Formerly *Ectobia.*)

For general article see Marlatt, Cir. 51, Div. Ent., U. S. Dept. Agric., pp. 10–11, 1902.

Exhibit: Adult.

THE HOUSE CRICKET.

Gryllus domesticus Linn.

Exhibit: Adult.

THE CASE-MAKING CLOTHES MOTH.

Tinea pellionella Linn.

For general article see Marlatt, Cir. 36, Div. Ent., U. S. Dept. Agric., pp. 1–4, 1898.

Exhibit: Adult and figure.

THE TAPESTRY MOTH.

Trichophaga tapetzella Linn.

(Formerly *Tinea.*)

For general article see Marlatt, Cir. 36, Div. Ent., U. S. Dept. Agric., p. 5, 1898.

Exhibit: Figure.

THE WEBBING CLOTHES MOTH.

Tineola biselliella Hum.

(Formerly *Tinea.*)

For general article see Marlatt, Cir. 36, Div. Ent., U. S. Dept. Agric., pp. 4–5, 1898.

Exhibit: Adult and figure.

THE RED-LEGGED HAM BEETLE.

Necrobia rufipes DeG.

(Formerly *Corynetes.*)

Exhibit: Adult and figure.

THE LARDER BEETLE.

Dermestes lardarius Linn.

Exhibit: Adult and figure.

THE CARPET BEETLE OR "BUFFALO MOTH."

Anthrenus scrophulariæ Linn.

For general article see Howard, Cir. 5, Div. Ent., U. S. Dept. Agric., 1894.

Exhibit: Adult and figure.

THE CHEESE OR HAM SKIPPER.

Piophila casei Linn.

Exhibit: Adult.

THE FRUIT OR VINEGAR FLY.

Drosophila ampelophila Loew.

For general accounts see Howard, Bul. 4, n. s., Div. Ent., U. S. Dept. Agric., pp. 109–111, 1896; Proc. Wash. Acad. Sci., v. II, pp. 589–590, pl. 31, fig. 2, 1900.

Exhibit: Adult and figure.

THE LITTLE RED ANT.

Monomorium pharaonis Linn.

For general article see Marlatt, Cir. 34, Div. Ent., U. S. Dept. Agric., pp. 1–2, 1898. For bibliography and general account see Lintner, 11th Rpt. N. Y. St. Entom., pp. 109–114, 1896.

Exhibit: Adult and figure.

INSECTS WHICH MAY SPREAD DISEASE.

General articles: Howard, Farmers' Bulletin 155, U. S. Dept. Agric., 1902; also Bul. 30, n. s., Div. Ent., U. S. Dept. Agric., pp. 39–45, 1901.

THE YELLOW-FEVER MOSQUITO.

Stegomyia fasciata Fab.

(Is the intermediate host for the parasite of yellow fever. Formerly *Culex*.)

Exhibit: Adult and figure.

THE MALARIA MOSQUITO.

Anopheles maculipennis Meig.

(The most important of the mosquitoes transmitting malaria. Formerly *A. quadrimaculatus*.)

Exhibit: Adult and figure.

THE GREEN BOTTLE FLY.

Lucilia cæsar Linn.

For general article see Howard, Cir. 35, Div. Ent., U. S. Dept. Agric., 1898.

Exhibit: Adult and figure.

THE STABLE FLY.

Stomoxys calcitrans Linn.

For special article see Howard, Proc. Wash. Acad. Sci., v. II, pp. 577–579, fig. 27, 1900.

Exhibit: Adult and figure.

THE HIPPELATES FLY.

Hippelates flavipes Loew.

(Facilitates the spread of the disease known as "pink-eye.")

Exhibit: Adult and figure.

THE BROWN DUNG FLY.

Scatophaga furcata Say.

Exhibit: Adult and figure.

THE SHINING EXCREMENT FLY.

Morellia micans Macq.

Exhibit: Adult and figure.

THE LITTLE HOUSE FLY.

Homalomyia brevis Rond.

Exhibit: Adult and figure.

THE FRUIT OR VINEGAR FLY.

Drosophila ampelophila Loew.

Exhibit: Adult and figure.

THE SCREW-WORM FLY.

Chrysomyia macellaria Fab.

(Formerly *Compsomyia.*)

For special article see Howard, Proc. Wash. Acad. Sci., v. II, p 562, 1900.

Exhibit: Adult and figure.

THE CATTLE TICK.

Boophilus annulatus Say.

(Very common on cattle below the Texas fever line, and known to be responsible for transmission of Texas fever among cattle.)

Exhibit: Eggs, adult, and figure.

INSECTS WHICH DIRECTLY INJURE OR ANNOY HUMAN BEINGS.

THE HOUSE FLY.

Musca domestica Linn.

For general article see Howard, Cir. 35, Div. Ent., U. S. Dept. Agric., 1898.

Exhibit: Adult and figure.

THE SOUTHERN BUFFALO GNAT.

Simulium pecuarum Riley.

For general article and full life history see Osborn, Bul. 5, n. s., Div. Ent., U. S. Dept. Agric., pp. 41–52, 1896.

Exhibit: Adult and figure.

THE CAT AND DOG FLEA.

Ctenocephalus canis Curtis

(Formerly *Pulex serraticeps* Gerv.)

For general account see Howard and Marlatt, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., pp. 24–31, 1902. For full bibliography see Baker, Proc. U. S. N. M., v. XXVII, p. 438, 1904.

Exhibit: Figure.

THE BLOOD-SUCKING CONE-NOSE.

Conorhinus sanguisuga Lec.

For general article see Howard and Marlatt, Bul. 4, n. s., rev. ed., Div. Ent., U. S. Dept. Agric., pp. 38–42, 1902.

Exhibit: Egg, nymph, adult, and figure.

THE HOUSE MOSQUITO.

Culex pipiens Linn.

For general article and life history see Howard, Bul. 25, n. s., Div. Ent., U. S. Dept. Agric., pp. 22–28, 1900. Treated as *C. pungens* Wied.

Exhibit: Adult and figure.

THE BEDBUG.

Klinophilos lectularia Linn.

(Formerly *Acanthia* and *Cimex.*)

For general article see Marlatt, Cir. 47, Div. Ent., U. S. Dept. Agric., 1902.

Exhibit: Nymph, adult, and figure.

THE BLACK BEETLE.

Blatta orientalis Linn.

For general article see Marlatt, Cir. 51, Div. Ent., U. S. Dept. Agric., pp. 9–10, 1902.

Exhibit: Adult and figure.

THE RED BUG.

Leptus irritans Riley.

For general article see H. Osborn, Bul. 5, n. s., Div. Ent., U. S. Dept Agric., pp. 251–253, 1896.

Exhibit: Figure.

THE HEAD LOUSE.

Pediculus capitis DeG.

For general article see H. Osborn, Bul. 5, n. s., Div. Ent., U. S. Dept. Agric., pp. 166–167, 1896.

Exhibit: Figure.

THE BODY LOUSE.

Pediculus vestimenti Leach.

For general article see H. Osborn, Bul. 5, n. s., Div. Ent., U. S. Dept. Agric., pp. 167–168, 1896.

Exhibit: Figure.

THE CRAB LOUSE.

Phthirius inguinalis Leach.

For general article see H. Osborn, Bul. 5, n. s., Div. Ent., U. S. Dept. Agric., pp. 165–166, 1896.

Exhibit: Eggs, adult, and figure.

INSECTS INJURIOUS TO DOMESTIC ANIMALS.

For general account with illustrations of many of the insects affecting domestic animals see Osborn, Bull. 5, n. s., Div. Ent., U. S. Dept. Agric., pp. 1–302, 1896.

THE SOUTHERN BUFFALO GNAT.

Simulium pecuarum Riley.

Exhibit: Adult and figure.

THE TURKEY GNAT.

Simulium meridionale Riley.

Exhibit: Pupa, adult, and figure.

AMERICAN GAD-FLY.

Tabanus americanus Forst.

Exhibit: Adult.

THE GRAY-STRIPED GREEN-HEAD.

Tabanus lineola Fab.

Exhibit: Adult and figure.

THE BLACK GAD-FLY.

Tabanus atratus Linn.

Exhibit: Larva, adult, figure, and figure of parasite *Phanurus tabanivorus* Ashm.

THE GREENHEAD.

Tabanus costalis Wied.

Exhibit: Adult.

TABANUS EXUL O. S.

Exhibit: Adult.

TABANUS PUNCTIFER O. S.

Exhibit: Adult.

TABANUS CINCTUS Fab.

Exhibit: Adult.

MEXICAN BOT-FLY.

Tabanus mexicanus Linn.

Exhibit: Adult.

THE BLACK-STRIPED GAD-FLY.

Tabanus nigrovittatus Macq.

Exhibit: Adult.

THE BLACK-STRIPED EAR-FLY

Chrysops vittatus Wied.

Exhibit: Adult and figure.

CHRYSOPS ATROPOS O. S.

Exhibit: Adult.

CHRYSOPS HILARIS O. S.

Exhibit: Adult.

THE STABLE FLY.

Stomoxys calcitrans Linn.

For special article see Howard, Proc. Wash. Acad. Sci., v. II, pp. 577-579, fig. 27, 1900.

Exhibit: Adult and figure.

THE HORSE BOT-FLY.

Gastrophilus equi Fab.

Exhibit: Eggs, larva, puparia, adult, and figure.

THE "CHIN" FLY.

Gastrophilus nasalis Linn.

Exhibit: Adult.

THE WARBLE FLY.

Hypoderma bovis DeG.

(A European species.)

Exhibit: Eggs, adult and figure.

THE OX BOT; OX WARBLE.

Hypoderma lineata Vill.

Exhibit: Larva, adult, and figure.

THE SHEEP BOT-FLY; HEAD MAGGOT.

Œstrus ovis Linn.

Exhibit: Larva, puparia, adult, and figure.

THE HORN FLY.

Hæmatobia serrata R-D

For special article see Riley and Howard, Insect Life, v. II, pp. 93–103.

Exhibit: Puparium, adult, and figure.

THE SHEEP TICK.

Melophagus ovinus Linn.

Exhibit: Adult and figure.

THE SCREW-WORM FLY.

Chrysomyia macellaria Fab.

(Formerly *Compsomyia*.)

For special article see Howard, Proc. Washington Acad. Sci., v. II, p. 562, 1900.

Exhibit: Adult and figure.

THE CAT AND DOG FLEA.

Ctenocephalus canis Curtis.

(Formerly *Pulex serraticeps* Gerv.)

For full bibliography see Baker, Proc. U. S. N. M., v. XXVII, p. 438, 1904.

Exhibit: Figure.

THE SUCKING HORSE-LOUSE.

Hæmatopinus asini Linn.

Exhibit: Figure.

THE SHORT-NOSED OX-LOUSE.

Hæmatopinus eurysternus Nitsch.

Exhibit: Figure.

THE LONG-NOSED OX-LOUSE.

Hæmatopinus vituli Linn.

Exhibit: Adult and figure.

THE CATTLE LOUSE.

Trichodectes scalaris Nitsch.

Exhibit: Adult and figure.

THE SHEEP LOUSE.

Trichodectes sphærocephalus Nitsch.

Exhibit: Adult and figure.

TICKS INJURIOUS TO DOMESTIC ANIMALS.

For general account, bibliography, and illustrations see Salmon and Stiles, Cattle Ticks, 17th Ann. Rept. B. A. I., U. S. Dept. Agric., pp. 380–491, 1900.

THE CATTLE TICK.

Boophilus annulatus Say.

(Very common on cattle below the Texas fever line and known to be responsible for transmission of Texas fever among cattle.)

Exhibit: Adult and figure.

THE SOUTHERN CHICKEN TICK.

Argas miniatus Koch.

(Also reported on cattle.)

Exhibit: Adult and figure.

THE SPINOSE EAR TICK.

Ornithodoros megnini Dugés.

(On man, cattle, horses, dogs, sheep, etc.)

Exhibit: Adult and figure.

THE AMERICAN DOG TICK.

Dermacentor electus Koch.

(On man, cattle, dogs, and horses.)

Exhibit: Adult and figure.

THE NETTED TICK.

Dermacentor reticulatus Fab.

(On man, cattle, horses, and sheep.)

Exhibit: Adult and figure.

THE LONE-STAR TICK.

Amblyomma americanum Linn.

(Not uncommon on cattle and man.)

Exhibit: Adult and figure.

THE CASTOR-BEAN TICK.

Ixodes ricinus Linn.

(On man, cats, dogs, cattle, goats, horses, rabbits, etc.)

Exhibit: Adult and figure.

SPECIAL EXHIBIT OF MODELS OF INSECTS AND OF PLANTS AND INSECTS AFFECTING THEM.

YELLOW FEVER MOSQUITO.

Stegomyia fasciata Fab.

Enlarged model. This mosquito transmits yellow fever and it is now the opinion of the best-posted experts that only through its bite can one contract this disease.

MALARIA MOSQUITO.

Anopheles maculipennis Meig.

Enlarged model. This and other species of Anopheles are the only known transmitters of human malaria. The parasitic organism causing malaria inhabits the red-blood cells of human beings. It is taken with the blood into the stomach of the mosquito. There it undergoes a sexual development, reproduces, and the offspring are carried with the mosquito poison into the circulation of healthy human beings.

SALT MARSH MOSQUITO.

Culex sollicitans Walk.

Enlarged model. This mosquito is not known to carry any disease, but is very annoying at many seaside resorts.

THE HOUSEFLY.

Musca domestica Linn.

Enlarged model. The housefly is not merely a nuisance, but also acts as a carrier of many diseases, especially in the United States of typhoid fever.

HESSIAN FLY.

Cecidomyia destructor Say.

One of the most injurious enemies of wheat in the Northern and Central States. The larva attacks the stem. The average yearly damage to the wheat industry in this country from this insect is $60,000,000.

Enlarged models are exhibited of the adult fly, and of an infested stalk of wheat showing the so-called "flaxseed" stage of the insect.

Two natural-size models are exhibited, one representing a healthy, unaffected young wheat plant to contrast with the same attacked by the Hessian fly; the other illustrating the effects of the attacks of the Hessian fly.

GRAPE-VINE TRUMPET-GALL.

Lasioptera viticola O. S.

Model in wax of the abnormal growths caused by the sting of a minute dipterous insect not infrequently observed on the leaves of the grape.

GRAPE-VINE TOMATO-GALL.

Lasioptera vitis O. S.

Model in wax of the abnormal growths on terminal twigs of the grape, caused by the sting of a little gnat.

GRAPE-VINE PHYLLOXERA-GALL.

Phylloxera vastatrix Planch.

Model in wax of the galls produced by the leaf form of the grape Phylloxera, showing their characteristic appearance and disposition on the leaf.

SOCIAL GRAPE CATERPILLAR.

Harrisina americana Harr.

Twigs of grape-vine modeled in wax, showing the characteristic appearance and work of the larvæ and their method of feeding in uniform rows on the leaf.

THE GRAPE-SEED WEEVIL.

Craponius inæqualis Say.

A bunch of grapes, showing damage to the berries by the larvæ of this insect; also punctures made by the female beetle in oviposition.

THE SILKWORM.

Bombyx (*Sericaria*) *mori* Linn.

Enlarged model of the larva, showing its complete anatomy; the muscles, nerves, trachæ, viscera, the silk apparatus in its whole extent, the silk-secreting gland, and the gland discovered by Auzoux, which secretes a liquid, the use of which is most probably to convert the silky matter into insoluble threads. In one of the prolegs may be seen the muscles which move the claws and sucking disks which enable the animal to walk with its true feet in the air.

Enlarged models of the moths, male and female. In each model is shown the atrophy of the digestive tube and the development of the marvelous organs by which the species is perpetuated. (After Auzoux.)

HOP PLANT-LOUSE.

Phorodon humuli Schr.

Unaffected Hop Plant.—A spray of hops, modeled in wax, representing the plant as it appears in vigorous growing condition, and free from the attacks of its principal enemy, the hop plant-louse to contrast the stronger foliage and the more abundant and larger hops produced by plants from which the hop louse has been eradicated by the use of proper remedies.

Affected Hop Plant.—A spray of hops modeled in wax, representing the vine as it appears when attacked by the hop plant-louse, showing the blackening and discoloration of the leaves and the small and inferior hops which are also discolored and otherwise unsuitable for market.

WINTER EGGS.—Enlarged model of the winter eggs, which are attached by the sexual female to the terminal twigs of the plum, in crevices around the buds.

STEM-MOTHER.—The stout female plant-louse shown in this enlarged model hatches from the winter egg and is characterized by shorter legs and honey-tubes. It gives birth without the intervention of the male to living young, of which three generations are produced on the plum trees, the last being winged and migrating to the hop.

WINGED MIGRANT.—This enlarged model represents the first winged generation, the third produced on the plum. It instinctively flies to the hop plant and is the progenitor of from five to twelve wingless generations of virgin females, which infest the hop plants until autumn, and are the sole forms which depredate on the hop. In autumn the last generation again produces winged females which fly to the plum trees.

HOP-AFFECTING STAGE. This enlarged model represents the structure and appearance of the five to twelve wingless generations of virgin females which people the hop plant until autumn. These are the progeny of the *winged migrants* and are the sole forms which injure the hop.

RETURN MIGRANT. This enlarged model represents the last generation produced on the hop, the winged migrant form which in September returns again to the plum and gives birth to three or more young, which are the true sexual females, the first perfect sexual females produced in the cycle up to this point.

PUPA OF RETURN MIGRANT. This model represents the pupal stage of the *return migrant*. The striking features are the wing pads, which with another molt become the ample flight organs seen in the model of the adult.

TRUE SEXUAL FEMALE. This enlarged model represents the generation born of the return migrant, which never acquire wings and never leave the plum tree. Maturing in a few days, according to the temperature, they are fertilized by the true winged males which have been subsequently developed on the hops, and have come from the hop fields to the plum. Shortly after fertilization the winter eggs, like those with which the cycle started, are deposited.

YOUNG SEXUAL FEMALE.—This enlarged model represents the newly hatched stage of the only perfectly developed sexual female produced in the life cycle of this insect.

WINGED MALE. This enlarged model represents the first and only male generation produced in the life cycle of the hop-plant louse. This is developed in the autumn, and flies from the hop to the plum and fertilizes the true sexual females.

CHINCH BUG.

Blissus leucopterus Say.

THE EGGS. This enlarged model represents the form of the egg and the terminal cap. The eggs are three-hundredths of an inch long, the top being squarely docked and surrounded by four round tubercles near the center. Color from pale whitish to amber.

FIRST LARVAL STAGE.—This stage, represented enlarged in this model, differs from the adult in being more elongate and in having two-jointed tarsi, the head broader and more rounded and the joints of the body subequal. The prevailing color of the whole body is red.

SECOND LARVAL STAGE. After the first molt the form represented in this enlarged model is assumed. The red becomes a brilliant vermilion and contrasts with the pale band across the middle of the body, while the head and prothorax are dusky and coriaceous. Two broad marks appear on the mesothorax and the second, fourth, and fifth abdominal sutures, and one at the tip of the abdomen.

PUPA.—The pupa shown in this enlarged model approaches still more nearly the form of the adult, and is not unlike the last larval stage except in being darker and in the appearance of wing-pads, which extend almost across the pale basal abdominal joints.

THE IMAGO. The mature insect which is represented enlarged in this model is elongate, blackish, and with numerous hairs, or pubescense. Its length is about three-twentieths of an inch. The outer wings are whitish, with a strong distinctive black spot.

THE SAN JOSE SCALE.

Aspidiotus perniciosus Comst.

Ten enlarged models are exhibited illustrating the life cycle of this pest, which has caused more damage to the fruit industry and been the object of more legislation than any other insect. Its small size and inconspicuous appearance often leave it undetected until the infested trees are beyond recovery. The scale may be killed by fumigation or spraying.

Enlarged models are exhibited of the *first* and *second larval stages*, of the *young crawling larva*, *nearly full-grown larva*, *male pro-pupa*, *male pupa*, *adult male*, *adult female*, and of the *half-grown scale*, *full-grown male scale*, and *full-grown female scale*.

THE ASIATIC LADY-BIRD.

Chilocorus similis Rossi.

Two enlarged models are exhibited illustrating the adult and the larva of this insect, which was introduced by the U. S. Department of Agriculture from China, where it is the important agent in keeping the San José scale in check.

THE CODLING MOTH.

Carpocapsa pomonella Linn.

Four enlarged models illustrating the life history of this insect which is the cause of the "wormy apples." The damage from it in this country is estimated at $11,000,000 annually.

Models are exhibited of the *larva* and of the *adult moth;* and also an enlarged section of a *piece of bark*, cut so as to show a cocoon and pupa of the codling moth beneath it, and an enlarged section of "wormy" apple showing egg, young, and mature larva and their work.

THE MEXICAN COTTON BOLL WEEVIL.

Anthonomus grandis Boh.

Enlarged model. This insect is a native of Cuba and Mexico; upwards of ten years ago the weevils crossed the Rio Grande near Brownsville and have now spread over nearly the entire cotton belt of Texas. Its rapid extension, great destructiveness, and the unusual difficulties in the way of its control have caused grave fears for the future of the cotton industry in the United States. The Federal Government has this year appropriated $250,000 for combating this insect.

THE HONEY BEE.

Apis mellifera Linn.

Enlarged models, reproducing the insect in six different forms—queen, male, wax-worker, worker, bee with propolis, and the bee with pollen. In these are shown the external and internal characters which distinguish each type. Also a model of a comb in the same proportion, in which are seen the cells for honey, for pollen, and for the eggs to produce queens, drones, and workers, with eggs, larvæ, and pupæ in different stages of development. (After Auzoux.)

THE EUROPEAN COCKCHAFER.

Melolontha vulgaris Fab.

Model of the perfect insect enlarged twelve times, showing the muscles, nerves, trachea, and viscera, each model separable into as many pieces as there are organs. More than 600 detailed objects are shown, each indicated by a corresponding number.

FLUTED SCALE.

Icerya purchasi Mask.

Model in wax of a twig of orange infested with the fluted scale (*Icerya purchasi*) copied directly from nature, the actual scales being transferred to the model plant. Illustrates the characteristic appearance of the infested plant.

Model of Noninfested Orange.—The model in wax contrasts with the one representing the characteristic appearance of infested plant.

Illustrations from the publications of the Division of Entomology, representing the different stages of the fluted scale and its principal enemies.

AUSTRALIAN LADYBIRD.

Novius (*Vedalia*) *cardinalis* Muls.

(Principal enemy of the fluted scale [*Icerya purchasi*].)

Enlarged model of the adult of this insect, the introduction of which from Australia has effected what was impossible by any other means—the practical annihilation of the fluted scale in California.

Enlarged models showing structure and characteristic appearance of the larva and pupa.

IMPORTED CURRANT WORM.

Pteronus ventricosus Klug.

This wax model of a currant branch illustrates the work of the imported currant worm. For extended exhibit of the insects affecting the currant see regular economic cases.

PLUM CURCULIO.

Conotrachelus nenuphar Hbst.

The work of the plum curculio on the fruit of the plum, apple, pear, cherry, and peach is illustrated by models. For full details as to the work of this insect see exhibit in regular economic series.

Young apples and pears, a twig of cherry and a branch of peach with ripening fruit, and twigs of plum with green and ripening fruit, illustrating the effects of punctures by the female curculio, are shown.

THE "KISSING BUG."

Reduvius personatus Linn.

Enlarged model of one of the group of true bugs, generally known as "assassin bugs," which of late years have acquired a certain newspaper notoriety through their supposed preference for the human lips. They feed on other insects, which they pierce with their strong beaks; some species are frequently found in houses, attracted by light, and they may, if they believe themselves in danger, accidentally or in defense, pierce the human skin with their beaks, causing a painful wound, and often blood poisoning through the introduction of the germs of putrefaction.

ORANGE RUST-MITE.

Eriophyes (*Phytoptus*) *oleivorus* Ashm.

Wax models of oranges, showing work of the orange rust-mite.

THE PARASITE CAUSING MALARIA (ÆSTIVO-AUTUMNAL FEVER).

Plasmodium malariæ.

Twenty-nine enlarged models, illustrating the life history of this parasite in the blood of man and in the mosquito (*Anopheles*).

The models exhibited show: Development of spores in the blood of man; development of "crescent" in the blood of man; development of "gamete" in stomach of mosquito; development and fertilization of "zygote" in stomach of mosquito; development of "zygote" in stomach wall of mosquito; "zygote" filled with "blasts" and ready to burst; free endospores, free blasts, and spermatozoa.

RIKER MOUNTS SHOWING LIFE HISTORIES OF INSECTS.

LEPIDOPTERA.

Eight-spotted Forester.
Alypia octomaculata Fab.
Grapevine Hog Caterpillar.
Ampelophaga myron Cram.
Stigma Moth.
Anisota stigma Fab.
Spring Maple Worm.
Anisota rubicunda Fab.
Maple Dagger Moth.
Apatela americana Harr.
Io Moth.
Automeris io Fab.
Calleta Silkmoth.
Callosamia calleta Westw.
Prometheus Silkmoth.
Callosamia promethea Dru.
Chainspotted Geometer.
Cingilia catenaria Cram.
Hickory Horned Devil.
Citheronia regalis Fab.
Cranberry Spanworm.
Cleora pampinaria Guen.
Yellow-Necked Caterpillar.
Datana ministra Dru.
Roller Worm.
Eudamus proteus Linn.
Brown-Tail Moth.
Euproctis chrysorrhœa Linn.
Large Beautiful Woodnymph.
Euthisanotia grata Fab.
Mourning Cloak.
Euvanessa antiopa Linn.
Oak Tussock Caterpillar.
Halisidota maculata Harr.
Social Grape Caterpillar.
Harrisina americana Guér.
White-Marked Tussock-Caterpillar.
Hemerocampa leucostigma S. & A.
Lunate Looper.
Homoptera lunata Dru.
Fall Webworm.
Hyphantria cunea Dru.
Fall Army Worm.
Laphygma frugiperda S. & A.
The Army Worm.
Heliophila (Leucania) unipuncta Haw.
Apple Tent-Caterpillar.
Malacosoma americana Harr.
The Baltimore.
Euphydryas phæton Dru.
Parsnip Butterfly.
Papilio polyxenes Fab.
Spice-Bush Swallowtail.
Papilio troilus Linn.
Cynthia Silkmoth.
Philosamia cynthia Dru.
Semicolon Butterfly.
Polygonia interrogationis Fab.
Gipsy Moth.
Porthetria dispar Linn.
Tobacco Worm.
Phlegethontius quinquemaculata Haw.
Jorulla Silkmoth.
Rothschildia jorulla Westw.
Orizaba Silkmoth.
Rothschildia orizaba Westw.
Polyphemus Silkmoth.
Telea polyphemus Cram.
The Bagworm.
Thyridopteryx ephemeræformis Steph.
Luna Moth.
Tropæa luna Linn.

ORTHOPTERA.

Walking Stick.

Anisomorpha buprestoides Stål.

Katydid.

Microcentrum retinerve Burm.

The Soothsayers or Rearhorses.

(Chinese and American Species.)
Paratenodera sinensis Sauss. and *Stagmomantis carolina* Burm.

COLEOPTERA.

Asparagus Beetles.

Crioceris asparagi Linn. and *C. duodecempunctata* Linn.

Elm Leaf Beetle.

Galerucella luteola Müll.

HEMIPTERA.

Seventeen-Year Locust.

Tibicen septendecim Linn.

SILKMOTHS.

THE JAPANESE SILKMOTH.

Antheræa yamamai Guér.

Exhibit: Cocoon, adult, and figure.

THE IO MOTH.

Automeris io Fab.

Exhibit: Larva, cocoon, and adult.

THE ANGULATED SILKMOTH.

Callosamia angulifera Wlk.

Exhibit: Adult.

THE PROMETHEUS SILKMOTH.

Callosamia promethea Dru.

Exhibit: Larva, cocoon, and adult.

THE CYNTHIA SILKMOTH.

Philosamia cynthia Dru.

Exhibit: Adult.

THE GIANT INDIAN SILKWORM.

Attacus atlas Linn.

Exhibit: Adult.

THE CECROPIA SILKMOTH.

Samia cecropia Linn.

Exhibit: Cocoon, adult, and figure.

THE COLUMBIA SILKMOTH.

Samia columbia Sm.

Exhibit: Cocoon and adult.

THE PACIFIC-COAST SILKMOTH.

Samia rubra Behr.

EXHIBIT: Larva and adult.

THE POLYPHEMUS SILKMOTH.

Telea polyphemus Linn.

EXHIBIT: Cocoon, adult, and figure.

THE LUNA SILKMOTH.

Tropæa luna Linn.

EXHIBIT: Larva, cocoon, and adult.

MISCELLANEOUS EXHIBITS.

SILKWORMS.

The rearing of silkworms will be conducted on a small scale throughout the summer. Eggs will be kept in cold storage, so that all stages, from the egg to the full-grown larva spinning its cocoon, may be seen at any time during the season.

LIVING INSECTS.

By means of aquaria, vivaria, and other forms of insect cages living insects will be on exhibit, feeding on their natural food plants and undergoing their usúal transformations.

Some of the more important economic species injuring cotton and apple will be reared on growing specimens of these plants. In the smaller aquaria may be seem stages of some of the species of mosquitoes frequenting St. Louis and vicinity.

There will also be exhibited one box illustrating the methods of mounting insects for shipment and for permanent preservation in collections; also numerous photographs showing spraying machinery, reeling of silk from cocoons, silk machinery, etc.

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U. S. DEPARTMENT OF AGRICULTURE.

DIVISION OF ENTOMOLOGY—BULLETIN No. 48.

CATALOGUE

OF

EXHIBITS OF INSECT ENEMIES OF FORESTS AND FOREST PRODUCTS

AT THE

LOUISIANA PURCHASE EXPOSITION, ST. LOUIS, MO., 1904.

PREPARED UNDER THE DIRECTION OF THE ENTOMOLOGIST BY

A. D. HOPKINS,

In Charge of Forest Insect Investigations.

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U. S. DEPARTMENT OF AGRICULTURE.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Entomology,
Washington, D. C., May 23, 1904.

Sir: I have the honor to transmit herewith manuscript of a catalogue of the exhibit of insect enemies of forests and forest products of the Louisiana Purchase Exposition held at St. Louis, Mo., during the present year. It has been prepared under my direction by Dr. A. D. Hopkins, in charge of Forest Insect Investigations, in the hope of increasing the economic value of the exhibit, and is practically a continuation of the catalogue of the general exhibit which has been published as Bulletin 47 of the present series. The catalogue has been divided into four sections, as fully explained by its author. In the preparation of the exhibit Doctor Hopkins has had the expert assistance of Prof. W. E. Rumsey, of the West Virginia Experiment Station, and, later, of Mr. W. F. Fiske, of this Division, who has also assisted in the preparation of the catalogue. I recommend its publication as Bulletin No. 48 of this Division.

Respectfully,

L. O. Howard,
Entomologist.

Hon. James Wilson,
Secretary of Agriculture.

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CATALOGUE OF EXHIBITS OF INSECT ENEMIES OF FORESTS AND FOREST PRODUCTS AT THE LOUISIANA PURCHASE EXPOSITION.

INTRODUCTORY.

The extent of depredations by insects on the principal kinds of trees in different sections of the country, the magnitude of the problems demanding investigation, and the growing demand for information on causes and remedies led to the establishment of a section of the Division of Entomology for forest-insect investigations, which was organized on July 1, 1902.

The object of this section is to conduct original research in the field and laboratory, to determine the principal insect enemies of forest trees and forest products, and especially to determine facts relating to life histories, habits, distribution, character of injury, and natural enemies on which to base recommendations of methods for preventing losses.

Information acquired from observations by the author in all but one State, relating to the character and extent of the work of insects which are either detrimental or destructive to the forest resources and products of the country, leads him to estimate the average annual losses at $100,000,000. This is based on late stumpage values and wholesale prices of commercial products.

CHARACTER OF THE EXHIBIT.

The object of the exhibit is to show the character of work and injury, the various kinds of insects which cause the injury, and also the kinds which are beneficial on account of their habits of preying upon the injurious ones.

The labels give brief information as to the common or English names and technical or Latin names of insects, followed by brief descriptions of the character of their work, habits, and distribution, and the kinds of trees or wood injured. When the species is of special importance, reference is made to the principal publications concerning them.

In the preparation of sections 2, 3, and 4 of the exhibit, including labels, the author wishes to acknowledge the valuable service of Mr. W. F. Fiske.

The exhibit is in four sections, and consists of fifty-four cases, one large wall case, and a set of photographs. There are in all 789 specimens of insects, 623 specimens of work, and 18 photographs. Sections 1, 2, and 4 are in the Division of Entomology exhibit in the Government Building, while section 3 is in the forestry building, with the Bureau of Forestry exhibit.

Section I.—INSECT ENEMIES OF FORESTS IN THE NORTHWESTERN AND THE NORTHEASTERN STATES.[a]

This exhibit consists of material collected by the author during special investigations for the Division previous to the organization of the forest-insect investigations as a separate section.

The labels are copied in this catalogue with such revisions, corrections, and additional matter as seems necessary.

Reports of the two special investigations, during which the specimens were collected, will be found in Bulletin No. 21, n. s., of the Division of Entomology, entitled, "Preliminary Report on the Insect Enemies of Forests in the Northwest;" and Bulletin No. 28, n. s., "Insect Enemies of the Spruce in the Northeast." The exhibit was prepared by the author, assisted by Mr. W. E. Rumsey, of the West Virginia Experiment Station.

Section II.—INSECT ENEMIES OF FORESTS IN GENERAL.

This section consists of material collected since the 1st of July, 1902, and such other specimens in the general collection of the Division of Entomology and the National Museum as were not represented in the forest insect collections. It will be found in cases 25 to 48, inclusive, and in a large wall case. In this section the transformations and work of several representatives of each class of insects are shown, while other species, having analogous habits and transformations, are represented by the adult insects alone.

Section III.—INSECT ENEMIES OF FORESTS (SPECIAL PROBLEMS UNDER INVESTIGATION, IN COOPERATION WITH THE BUREAU OF FORESTRY).

This section comprises specimens collected by the author and assistants during special investigations of some of the principal depredations by forest insects now attracting attention. It will be found in six large cases, numbered 49 to 54, in the Forestry Building, in connection with the exhibit of the Bureau of Forestry. The exhibit shows the character of work of some of the most destructive enemies of forests and the insects which are responsible for the damage. The labels give general information regarding the insects and their habits, which will aid the forester and the lumberman in recognizing them when met with.

---

[a] This exhibit was shown at the Pan-American Exposition, at Buffalo, New York, in 1901, and at the Interstate and West Indian Exposition at Charleston, S. C., in 1901–2.

Section IV.—PHOTOGRAPHS OF INSECT DAMAGE TO FORESTS.

The photographs of insect damage are enlarged from 4 by 5 and 5 by 7 negatives taken by the author and his assistants, and show some of the features of insect work which could not well be represented by specimens.

GENERAL DESCRIPTION OF THE EXHIBIT.

A large amount of the material in the exhibit represents the first of the kind collected, and many of the descriptions of the work, host plants, habits of the insects, etc., on the labels and in this catalogue, are original.

The exhibit represents several quite distinct classes of enemies, as related to orders and groups of insects, the parts of trees attacked, primary or secondary injuries, etc. This is indicated to a certain extent by the arrangement of the specimens in the cases, and by the labels; but in order to prevent duplication in the catalogue, the descriptions of the principal classes of insects and the character of their work are included in the introduction, classified primarily according to the part of the tree or kind of product injured, and secondarily according to the class of insects which have similar habits.

The term "trunk and branches" not only refers to living trees, but to dying, dead, and felled trees, sawlogs, and like crude products.

INSECTS INFESTING THE BARK.

BARK-BEETLES.

[Plates I–VIII.]

This class of beetles attacks living, dead, and recently felled trees. The parent adults excavate their brood galleries through the inner layers of bark and often groove the outer surface of the wood. Their eggs are deposited along the sides of the galleries and the young broods develop in the bark and transform to the adult either in the bark or outer sapwood. Some of the species attack living trees, causing their rapid death, and are among the most destructive enemies of American forests; others are of secondary importance in attacking the injured trees and contributing to their death, while still others attack only the bark and twigs of dying and dead trees.

BARK AND WOOD BORING GRUBS.

This class of enemies differs from the preceding in the fact that the parent beetles do not burrow into the wood or bark, but deposit their eggs in the surface. The elongate, whitish, round-headed (Cerambycid), flat-headed (Buprestid), or short, stout (Curculionid) grubs hatching from these eggs cause injury by burrowing beneath the bark or deep into the sapwood and heartwood of living, injured, and dead trees, sawlogs, etc. Some of the species infest living trees, causing serious injury or death. Others attack only dead and dying bark and wood, but this injury often results in great loss from the so-called worm-hole defects.

BARK-WEEVILS.

This class of insects includes species which injure and kill the central shoots of pine and spruce, such injury often resulting in deformed and worthless matured trees. Others attack the base of young trees and apparently cause their death, or breed in the bark of injured and dying standing trees, and logs and stumps of those recently felled.

BARK AND WOOD BORING CATERPILLARS.

This class includes the young of clear-winged, wasp-like moths, which mine in the bark and wood of living trees, causing masses of pitch to form over the wound. They often cause serious damage to reproduction and plantations of conifers and other trees.

INFESTING THE WOOD.

AMBROSIA OR TIMBER BEETLES.

This class of insects attack living, dead, and felled trees, sawlogs, green lumber, and stave-bolts, often causing serious injury and loss from the pin-hole and stained-wood defects caused by their brood galleries. The galleries are excavated by the parent beetles in the sound sapwood, sometimes extending into the heartwood, and the young stages feed on a fungous growth which grows on the walls of the galleries.

TIMBER WORMS.

This class of true wood-boring "worms," or grubs, are the larvæ of beetles of the families Lymexylidæ and Brenthidæ. They enter the wood from eggs deposited in wounds in living trees, from which they burrow deep into the heartwood. Generation after generation may develop in the wood of a tree without affecting its life, but the wood is rendered worthless for most purposes by the so-called worm-hole and pin-hole defects resulting from their burrows. The same species also breed in the wood of dying and dead standing trees, and in the stumps and logs of felled ones, often for many years after the trees are felled. One species sometimes attacks freshly sawed oak lumber, new stave bolts, etc. They are among the most destructive enemies of hard-wood forest trees, especially in reducing the value of the wood of the best part of the trunks.

THE CARPENTER WORMS.

These are large pinkish caterpillars which are the larvæ of stout-bodied moths. They enter the bark and wood of living oak, locust, poplar, and other trees from eggs deposited by the moths in the crevices of uninjured bark, or in the edges of wounds. They burrow deep into the solid wood, where they live for two or three years before transforming to the adult. The wood is seriously injured by the very large worm-hole defects, and while the life of the tree is but slightly, if at all, affected by the earlier attacks, the continued operations of this class of borers year after year finally results in the decay of the heartwood, or a hollow trunk and a dead top.

HORN-TAILS.

This is a class of borers which are the larvæ of the so-called wood wasps. They may enter the exposed dead wood of wounds of living trees, but more commonly attack the wood of dead standing conifers and hard woods, in the sapwood of which they excavate irregular burrows, which are packed with their borings. When the adults emerge they leave the surface perforated with numerous round holes. Water and fungi entering these holes cause a very rapid decay of the wood.

POWDER-POST BEETLES.

This is a class of insects representing two or three families of beetles, the larvæ of which infest and convert into fine power many different kinds of dry and seasoned wood products, such as hickory and ash handles, wagon spokes, lumber, etc., when wholly or in part from the sapwood of trees. Oak and hemlock tan bark is sometimes injured to a great extent, and the structural timbers of old houses, barns, etc., are often seriously injured, while hoop poles and like products are attacked by one set of these insects, the adults of which burrow into the wood for the purpose of depositing their eggs.

INSECTS INJURING LEAVES.

THE TRUE CATERPILLARS.

These are the larvæ of butterflies and moths, and include a great variety of forms which feed on the leaves of all kinds of forest trees. Some attack the opening buds, others the very young leaves, while others consume the mature foliage. The greater number cause no perceptible injury, yet there are some, like the forest tent caterpillar, the pine butterfly, the western hemlock span-worm, etc., which are capable of widespread devastation.

FALSE CATERPILLARS.

These are the larvæ of a class of insects which are related to the bees, but have very peculiar habits as compared with other insects of the order (Hymenoptera) to which they belong. The adults are called sawflies, on account of the peculiar saw-like ovipositor, by means of which they make incisions in the living plant tissue for the reception of their eggs. The larvæ are often found in great numbers on pine, dogwood, birch, elm, cultivated currant, etc., completely defoliating the plant in a short time. Some of the species are capable of widespread destruction of certain kinds of trees, as, for example, the larch sawfly (*Nematus erichsonii*), which between 1882 and 1885 destroyed to an alarming extent the eastern larch or tamarac in New England and Canada.

THE LEAF-BEETLES.

This is a class of defoliators of which both the adults and the larvæ feed on the leaves. The willow and elm leaf-beetles are common examples of the more destructive kinds.

GALL INSECTS.

The galls on the leaves of various trees are produced in great variety by several distinct classes of gall-making insects. As a rule, each species, or a class of allied species, make galls of peculiar forms, by which the species or class to which they belong may be identified. Some galls are caused by four-winged gnats of the order Hymenoptera, others of the two-winged gnats of the order Diptera, and still others by plant-lice, Psyllids, etc., of the order Hemiptera.

PLANT-LICE.

This is a class of soft-bodied insects which cluster in great numbers on the leaves, injuring them by sucking out their sap, causing a faded or curled appearance, and often doing serious damage.

INSECTS INFESTING THE TWIGS.

TWIG-BEETLES.

These are small bark-beetles, which confine their operations to the smaller twigs, and either mine under the bark or into the pith. They rarely attack living twigs, but are exceedingly abundant in those of dying and recently felled trees, and may in some cases contribute to the rapid death of trees attacked by other insects.

TWIG-WEEVILS.

This is a class of snout beetles or so-called weevils which deposit their eggs in the living, dying, and dead twigs of trees, and the larvæ mine in the bark and pith. When they infest the twigs of living trees they often do considerable damage.

TWIG CATERPILLARS.

These are the larvæ of moths, which burrow into the terminal twigs of pine and other conifers and often cause serious harm. There are also certain kinds which attack the bark of the twigs and cause masses of pitch to form, in which they live.

SCALE INSECTS.

This is an extensive class of insects which infest the bark of all sorts of trees and are often very injurious. The young, after hatching from the eggs or mother scales, crawl about and attach themselves to the bark by means of their long, slender beaks. Many species exude a kind of wax which forms a scale-like covering which protects them during their period of growth.

PLANT-LICE.

These are similar to the plant-lice which infest the leaves, but certain kinds confine their attack to the twigs, especially some of those belonging to the genus *Lachnus*. Some of them are covered with a cottony or wool-like substance, while others are large, black, and shining.

GALL INSECTS.

There are many kinds of gall insects which produce galls on the twigs of forest trees, and like those causing galls on the leaves represent several orders and families.

CICADAS.

This is a class of insects of which the periodical cicada is a common example. They often cause serious injury to the twigs, which they puncture for the purpose of depositing their eggs.

INSECTS INJURIOUS TO FRUIT OR SEEDS.

This designation refers to insects which attack the young to matured fruit and seeds on the living tree, or after they have fallen.

WEEVILS.

This is a class of snout-beetles which are often very injurious to acorns and various kinds of nuts. The eggs are deposited in the young fruit and the young larvæ live on the inner portion until the nut or fruit has matured and falls to the ground, when they burrow their way out and go into the ground to transform to adults, which come out the next year in time to repeat the operation.

CONE AND NUT WORMS.

The cones and fruit of pine, spruce, and other conifers and nut-bearing trees are often infested by small caterpillars which prevent the development of the cones and seeds.

GALLS.

There are certain gall insects which attack cones and cause a deformed development either of the cone or the seeds.

INSECT INJURY TO FOREST PRODUCTS.

Insects injure various kinds of crude and finished forest products and reduce their value or render them entirely worthless.

INJURY TO FRESHLY CUT PRODUCTS.

This is caused by a class of insects which attack freshly sawed lumber, square timber, stave bolts, etc. (See Timber beetles and Timber worms.)

INJURY TO DRY AND SEASONED PRODUCTS.

This is caused by a class of insects which attack the sapwood of seasoned lumber, handles, spokes, and the like; also tan bark. (See Powder-post beetles.)

BENEFICIAL INSECTS.

Predaceous insects.—This is a class consisting of beetles, wasps, and true bugs, which feed on injurious insects and are often very beneficial in reducing the numbers of some of the more destructive kinds.

Parasitic insects.—This is a class which is represented by the four-winged and two-winged flies, the larvæ of which either live within the bodies of the larvæ and adults of injurious insects or attach themselves to the bodies of the larvæ and pupæ and kill them. This class is a very extensive one, and is of enormous benefit in reducing the numbers and keeping in check the ravages of the destructive species.

METHOD OF PREVENTING LOSSES.

The methods of preventing losses from depredations by forest insects consist mainly in the adoption of improved methods of forest management, based on a knowledge of the life histories and habits of the primary and secondary enemies of the trees and the natural enemies of the insects. Recommendations for the application of any method must be based on a knowledge of the special insect or group of insects found to be primarily to blame for the losses, and must necessarily vary in the details to suit the requirements of local conditions, different kinds of insects, different kinds of trees, and different kinds of forest products; it is therefore difficult and scarcely advisable to give any general recommendations in this connection for preventing losses. This will be brought out in future publications, reports, and special correspondence.

CATALOGUE OF EXHIBIT.

Section I.—INSECT ENEMIES OF FORESTS IN THE NORTHWESTERN AND NORTHEASTERN UNITED STATES.
Section II.—INSECT ENEMIES OF FORESTS IN GENERAL.
Section III.—SPECIAL INVESTIGATIONS.
Section IV.—PHOTOGRAPHS.

SECTION I.

INSECT ENEMIES OF FOREST TREES IN THE NORTHWESTERN AND NORTHEASTERN UNITED STATES.

NORTHWESTERN STATES.

INJURY BY AMBROSIA BEETLES. ORDER COLEOPTERA, FAMILY SCOLYTIDÆ.

CASE 1.

1. The Western Platypus (*Platypus* n. sp.).

Excavates long, branching galleries in the sapwood and heartwood of injured, dying, and recently felled Douglas spruce, western hemlock, and giant arbor vitæ. California to northern Oregon; also reported from Washington.

Exhibit: Adult and work.

2. Western Hemlock Wood-Stainer (*Gnathotrichus sulcatus* Lec.).

Excavates numerous branching galleries from a central burrow, the broods living in closely joined side chambers; in the sapwood and heartwood of western hemlock, Douglas spruce, giant arbor vitæ, and grand fir. California to northern Washington; common in hemlock.

Exhibit: Adult and work.

3. The Western Pine Wood-Stainer (*Gnathotrichus* n. sp.).

Excavates transverse galleries in the surface of the wood and branching ones deep in the sapwood and heartwood, the broods living in short side chambers; western yellow pine and Douglas spruce. Cascade and Rocky Mountain region, California to northeastern Washington.

Exhibit: Adult and work.

4. The Eastern Pine Wood-Stainer (*Gnathotrichus materiarius* Fitch).

Excavates several branching galleries from a single-entrance burrow, the broods living in short side chambers in sapwood and heartwood of injured, dying, and recently felled pine and spruce. Eastern United States and Canada. Very common and injurious.

Exhibit: Adult and work.

5. The Spruce Timber-Beetle (*Trypodendron bivittatus* Kirby).

Excavates several branching galleries from a single entrance burrow, the brood developing in short side chambers in the sapwood of injured, dying, and recently felled spruce, pine, hemlock, cedar, fir, and larch. Eastern, northeastern, and western United States, Canada, and British Columbia to Alaska; very injurious.

Exhibit: Adult and work.

6. The Birch Timber-Beetle (*Trypodendron* n. sp.).

Excavates branching galleries from an entrance burrow and the broods develop in short side chambers in sapwood and heartwood of paper birch. Kootenai, Idaho, and northwestern Maine; also other birches in Maine.

Exhibit: Adult and work.

7. The Cosmopolitan Timber-Beetle (*Xyleborus saxeseni* Ratz.).

Excavates branching galleries and broad brood chambers from an entrance burrow in sapwood and heartwood of Douglas spruce in Oregon, red oak in Maine, apple and hemlock in West Virginia, and oak, beech, maple, lime tree, poplar, pine, spruce, and fruit trees in Europe. Widely distributed in different countries of the world, especially in Europe, North America, and Japan.

Exhibit: Adult and work.

INJURY BY BARK-BEETLES. ORDER COLEOPTERA, FAMILY SCOLYTIDÆ.

CASE 2.

8. The Hairy Cryphalus (*Cryphalus* n. sp.).

Excavates broad, irregular chambers in dying and dead bark of grand fir. Port Williams, Wash.

Exhibit: Adult and work.

9. The Western Oak Bark-Beetle (*Pityophthorus pubipennis* Lec.).

Excavates two transverse galleries from a central entrance burrow in the bark of injured, dying, and recently felled California black oak, Oregon white oak, and possibly other oaks. California to Oregon.

Exhibit: Adult and work.

10. The Densely-punctured Bark-Beetle (*Pityophthorus confinis* Lec.).

Excavates a large central chamber and several radiating primary galleries with very deep egg cavities in living bark of injured, dying, and recently felled western yellow pine. Northern California, eastern Washington, and western Idaho.

Exhibit: Adult and work.

11. The Lodgepole Pine Bark-Beetle (*Pityophthorus* n. sp.).

Excavates radiating curved longitudinal galleries from a medium-sized central chamber in living bark on large branches of dying lodgepole pine. Eastern Washington.

Exhibit: Adult and work.

12. The Knobcone Pine Bark-Beetle (*Pityophthorus* n. sp.).

Excavates several radiating galleries from a large central chamber in living bark on branches of injured and dying knobcone pine and western yellow pine. Berkeley, Cal., and Albany, Oreg.

Exhibit: Work.

13. The Monterey Pine Twig-Beetle (*Pityophthorus puncticollis* Lec.).

Excavates small radiating, curved, galleries from a large central chamber in twigs and branches of dying and felled Monterey pine, shore pine, western yellow pine, knobcone pine, Sitka spruce, and mountain or silver pine. Middle California to northern Washington.

Exhibit: Adult and work.

14. The Sitka Spruce Twig-Beetle (*Pityophthorus nitidulus* Mann.).

Excavates three or four radiating galleries from a medium-sized central chamber in bark of Sitka spruce, mountain pine, shore pine, and Douglas spruce. California to Alaska, coast and Cascade region. Common.

EXHIBIT: Adult and work.

15. The Jeffrey Pine Twig-Beetle (*Pityophthorus* n. sp.).

Excavates small central chambers and long longitudinal galleries in living bark of twigs and branches on living, injured, dying, and recently felled Jeffrey pine and western yellow pine. Mount Shasta, California, to Albany, Oreg., and Moscow Mountains, Idaho.

EXHIBIT: Adult and work.

16. The Smaller Fir Bark-Beetle (*Pityophthorus* n. sp.).

Excavates transverse galleries from a central chamber in the bark of dying grand fir and mountain or silver pine. Kootenai, Idaho.

EXHIBIT: Adult and work.

CASE 3.

17. The Mountain Pine Wood-Engraver (*Pityogenes* n. sp.).

Excavates large central chambers and numerous curved primary galleries in the bark and surface of wood of injured, dying, and recently felled mountain or silver pine and grand fir. Kootenai, Idaho.

EXHIBIT: Adult and work.

18. The Yellow Pine Wood-Engraver (*Pityogenes carinulatus* Lec.).

Excavates numerous radiating galleries from a large central chamber in living bark and surface of wood of injured, dying, and recently felled western yellow pine and Jeffrey pine. California to eastern Washington, western Idaho, and Colorado.

EXHIBIT: Adult and work.

19. The Western Fir Bark-Beetle (*Tomicus* n. sp.).

Excavates several radiating, curved, transverse galleries from a small central chamber in the bark and surface of wood of injured, declining, or dying grand fir, California white fir. Mount Shasta, California, and Moscow Mountains, Idaho. Common.

EXHIBIT: Adult and work.

20. The Smaller Sugar Pine Tomicus (*Tomicus latidens* Lec.).

Excavates two or three longitudinal galleries from a small central chamber in living bark of branches of dying and recently felled sugar pine. Grants Pass, Oregon; also California to Colorado.

EXHIBIT: Adult and work.

21. The Sitka Spruce Tomicus (*Tomicus concinnus* Mann.).

Excavates irregular central chambers, and three or four short curved galleries, in partly living bark of injured, dying, and recently felled Monterey pine, shore pine, and Sitka spruce. Coast region, middle California to Alaska.

EXHIBIT: Adult and work.

22. The Oregon Tomicus (*Tomicus oregoni* Eichh.).

Excavates two or three longitudinal galleries from a small central chamber in the bark of living, injured, dying, and recently felled western yellow pine, lodgepole pine, silver pine, and probably other pines in the Northwest. Destructive to the western yellow pine in western Idaho.

EXHIBIT: Adult and work.

23. The Western Five-Spined Tomicus (*Tomicus confusus* Lec.).

Excavates one to three long longitudinal galleries from a medium-sized central chamber in the living bark of injured, dying, and recently felled yellow pine. Mount Shasta, California, and Grants Pass, Oregon; also recorded from southern California and Arizona.

EXHIBIT: Adult and work.

CASE 4.

24. The Silver Pine Tomicus (*Tomicus* n. sp.).

Excavates very long, straight, longitudinal, and transverse curved galleries from a large central chamber in the bark of living, injured, dying, and recently felled mountain or silver pine and sugar pine. Grants Pass, Oregon, and Kootenai, Idaho. Common and evidently a destructive species.

EXHIBIT: Adult and work.

25. The Four-Spined Tomicus (*Tomicus integer* Eichh.).

Excavates several longitudinal primary galleries from a large central chamber in living bark of western yellow pine and lodgepole pine. Eastern Washington; also recorded from California, Washington, and Colorado.

EXHIBIT: Adult and work.

CASE 5.

26. The Sugar Pine Wood-Engraver (*Carphoborus* n. sp.).

Excavates several long, curved, longitudinal galleries in the surface of the wood from a deep central chamber in injured or dying sugar pine, yellow pine, Douglas spruce, and Sitka spruce. Grants Pass, St. Helen, and Ahlers, Oregon; also middle California.

EXHIBIT: Adult and work.

27. The Western Cedar Bark-Beetle (*Phlœosinus punctatus* Lec.).

Excavates a single straight longitudinal or curved subtransverse gallery from a basal chamber in the living bark and surface of wood of injured, dying, and recently felled giant arborvitæ, incense cedar, and Port Orford cedar. California to northern and eastern Washington and Rocky Mountain region. Common.

EXHIBIT: Adult and work.

28. The Sitka Spruce Dolurgus (*Dolurgus pumilis* Mann.).

Excavates irregular, confused galleries in dying and dead bark of dead and felled Sitka spruce. Southern and central Oregon.

EXHIBIT: Adult and work.

CASE 6.

29. The Redwood Bark-Beetle (*Phlœosinus sequoiæ* Hopk.).

Excavates a long, straight, longitudinal gallery from a basal chamber in living bark of injured, declining, and recently felled redwood and giant arborvitæ. California to northern Washington. Very common in redwood.

EXHIBIT: Adult and work.

CASE 7.

30. The Western Pine-Destroyer (*Dendroctonus brevicomis* Lec.).

Excavates long, winding galleries through the bark of living and injured western yellow pine and sugar pine. Cascade and Rocky Mountain region, New Mexico to British Columbia. Closely allied with the destructive pine bark-beetle of the East and capable of great destruction of the largest and best timber.

EXHIBIT: Adult and work.

CASE 8.

31. The Dark-Red Turpentine-Beetle (*Dendroctonus valens* Lec.).

The largest North American bark-beetle. Excavates very broad and long primary galleries, the broods developing in broad side chambers in the bark of living, injured, dying, and recently felled yellow pine, lodgepole pine, and doubtless most of the other western pines. California to British Columbia and eastward to Kansas and northern Michigan. A variety extends into the eastern United States. Common and injurious, but not necessarily destructive to living timber.

Exhibit: Adult and work.

32. The Mountain Pine Dendroctonus (*Dendroctonus* n. sp.).

A medium-sized black bark-beetle, excavating very long, winding galleries in the bark of living, injured or declining, and recently felled mountain or silver pine and sugar pine. Northern California to Washington eastward to Idaho and Montana. Very common and capable of great destruction of the best timber.

Exhibit: Adult and work.

CASES 9 AND 10.

33. The Douglas Spruce Dendroctonus (*Dendroctonus* n. sp.). (*Dendroctonus similis* in Division of Entomology, Bul. 21, n. s.).

A large, reddish bark-beetle, excavating long longitudinal, slightly curved primary galleries in the bark of living, injured, and recently felled Douglas spruce and western larch. New Mexico to British Columbia, Pacific coast and eastward through the mountain regions. Very common and capable of destroying much valuable timber.

Exhibit: Adult and work.

CASE 10.

34. The Western Pine Hylurgops (*Hylurgops subcostulatus* Mann.).

Excavates short, slightly curved, longitudinal galleries in the living bark of injured, dying, and recently felled sugar pine, western white pine, western yellow pine, lodgepole pine, and probably other pines on the Pacific coast. Cascade and Rocky Mountain region. Common.

Exhibit: Adult and work.

35. The Sitka Spruce Hylurgops (*Hylurgops rugipennis* Mann.).

Excavates a short, curved, longitudinal and subtransverse gallery from an entrance in the living bark of injured, dying, and recently felled Sitka spruce and shore pine. Coast region, California to Washington and Alaska.

Exhibit: Adult and work.

CASE 11.

36. The Fir Wood-Engraver (*Hylesinus* n. sp.).

Excavates a small central chamber at one side of the junction of two short transverse, slightly curved egg galleries, which are deeply grooved in the surface of the wood; the larvæ also groove or engrave the surface of the wood in an ornamental manner. Infests the grand fir and Douglas spruce. Port Williams and Port Angeles, Wash. Common.

Exhibit: Adult and work.

37. The Larger Fir-Tree Bark-Beetle (*Hylesinus granulatus* Lec.).

Excavates one or two transverse galleries from a central burrow in the bark and surface of wood near the base of dying grand fir. Port Williams, Wash.; also recorded from California.

Exhibit: Adult and work.

38. The Grand Fir Bark-Beetle (*Hylesinus* n. sp.).

Excavates two separate, transverse galleries from a central entrance burrow in the bark and surface of wood of recently felled grand fir. Port Angeles and Port Williams, Wash.

EXHIBIT: Work.

39. The Shore Pine Hylesinus (*Hylesinus sericeus* Mann.).

Excavates one short, longitudinal gallery from the entrance burrow and small side cavity in living bark of injured, dying, and recently felled shore pine. Newport and Seaside, Oreg. Common. Also recorded from California and Alaska.

EXHIBIT: Adult and work.

40. The Ash-Tree Bark-Beetle (*Hylesinus aculeatus* Say).

Excavates two long, transverse galleries, from a central entrance burrow and side cavity in the living bark of injured, dying, and recently felled ash. Atlantic to Pacific coast. Common. Specimens from Oregon ash, St. Helen, Oreg.

EXHIBIT: Adult and work.

41. The White-Alder Bark-Beetle (*Hylesinus aspericollis* Lec.).

Excavates a moderately long, longitudinal gallery from a basal entrance burrow in the bark of living, injured, dying, and recently felled white alder. Newport, Detroit, and Astoria, Oreg., and Seattle, Wash.; also recorded from California. A destructive enemy, causing the death of large trees.

EXHIBIT: Adult and work.

42. The Western Hemlock Bark-Beetle (*Hylesinus* n. sp.).

Excavates one or two transverse galleries from a central burrow in bark and surface of wood of living, injured, and recently felled western hemlock, causing "gum spot" defects in the wood of living trees, and may cause the death of the best timber. Newport, Oreg., and Port Angeles, Wash.

EXHIBIT: Adult and work.

CASE 12.

43. The Douglas Spruce Hylesinus (*Hylesinus nebulosus* Lec.).

Excavates two short, straight, longitudinal galleries from a central entrance burrow in the living bark of injured, dying, and recently felled Douglas spruce. California to British Columbia, and eastward to Idaho and Colorado. Very common.

EXHIBIT: Adult and work.

44. The Single Spine Scolytus (*Scolytus unispinosus* Lec.).

Excavates two short, straight, longitudinal galleries from an entrance burrow in living bark of injured, dying, and recently felled Douglas spruce and western larch. Pacific coast, Cascade and Rocky Mountain region. Common.

EXHIBIT: Adult and work.

45. The Fir-Branch Scolytus (*Scolytus* n. sp.).

Excavates two short, longitudinal galleries from a central burrow and side cavity in living bark of the branches of recently felled grand fir. Cascade Mountains near Grants Pass, Oregon.

EXHIBIT: Work.

46. The Smaller Fir-Tree Scolytus (*Scolytus* n. sp.).

Excavates two transverse or oblique, slightly curved galleries from a central entrance burrow and side cavity in the bark and surface of wood of injured and dying grand fir. Kootenai, Idaho.

EXHIBIT: Adult and work.

CASE 13.

47. The California White Fir Scolytus (*Scolytus praeceps* Lec.).

Excavates two, nearly straight, transverse galleries from a central entrance burrow and basal cavity in living bark and surface of wood of California white fir. Mount Shasta, California, and grand fir, Sand Point, Idaho. Closely allied in character and habits to No. 48.

EXHIBIT: Adult and work.

48. The Fir Tree Destroyer (*Scolytus subscaber* Lec.).

Excavates two long, nearly straight, transverse galleries from a central entrance burrow and central or side cavity, in bark of living, injured, and declining grand fir, California white fir, and doubtless other species of fir. California to British Columbia, eastern Washington, and western and northern Idaho. The healed-over wounds in living trees cause serious defects and rapid decay of the heartwood.

EXHIBIT: Adult and work.

BARK AND WOOD-BORING GRUBS. ORDER COLEOPTERA, FAMILIES BUPRESTIDÆ AND CERAMBYCIDÆ.

CASE 14, AND PART OF CASE 15.

49. The Douglas Spruce Bark-Borer (*Asemum nitidum* Lec.).

A round-headed, bark-boring grub, boring transverse and winding galleries in the bark of living, injured, and declining Douglas spruce and hemlock. Cascade Mountains, near Detroit, Oreg., St. Helen, Oreg., and Port Williams, Wash. A very common and destructive enemy of the Douglas spruce. The healed-over wounds in the wood cause serious defects, and the trees die from successive attacks.

EXHIBIT: Adult and work.

50. The White-Pine Sawyer (*Monohammus scutellatus* Say.).

A large, whitish round-headed, bark and wood-boring grub, excavating burrows through the sapwood and deep into the heartwood of fire-scorched, declining, dying, dead, and recently felled mountain or silver pine. Kootenai, Idaho, and white pine in eastern and northern United States. Common and destructive.

EXHIBIT: Adult and work.

51. The Ponderous Sawyer (*Ergates spiculatus* Lec.).

An exceedingly large, round-headed, bark and wood-boring grub, excavating large and deep burrows in the sapwood and heartwood of dead and felled western yellow pine; destructive to the wood of timber that has been dead or felled one or more years. Southern Oregon.

EXHIBIT: Adult and work.

52. The Western Cedar Bark-Borer (*Hylotrupes amethystinus* Lec.).

A medium-sized bark and wood-boring grub, excavating long, winding burrows in the living bark and surface of the wood and boring into the sapwood of injured, dying, and recently felled giant arbor vitæ and incense cedar. Northern California to Washington.

EXHIBIT: Work.

53. The Bronze Birch-Borer (*Agrilus anxius* Gory).

A long, flat-headed, slender, wood-boring grub, excavating long, winding burrows in the bark and surface of the wood of living and injured birch and poplar trees in northern Idaho, northern Maine, and mountains of West Virginia; also recorded from northern Michigan, New York, Pennsylvania, Virginia, Quebec, and Ontario. A destructive enemy of the birches and poplar.

EXHIBIT: Adult and work.

INJURY BY GALL INSECTS. ORDER HYMENOPTERA.

PART OF CASE 15.

54. Bird's-eye Pine (*Chalcidid?*).

A common condition of the wood of the western yellow pine evidently caused by a minute four-winged gnat, fragments of which were found in pitch galls in the bark of the main stem of young living pine. The formation of corky wood cells around the accumulation of pitch in the wound produces in the subsequent layers of wood the wavy and so-called birds-eye effect in the wood of larger trees. Insects found in specimen at Albany, Oreg. Specimen of wood from Grants Pass, Oreg.

EXHIBIT: Work.

55. The Oak-Twig Ormyrus (*Ormyrus* sp.).

A minute four-winged gnat breeding in small gall-like cavities in the living bark on the branches and twigs of the Oregon white oak in western Oregon, causing the small and large oak trees to present a dying appearance, due to the great number of dying twigs and dead leaves. The healed-over wounds produce deformed branches and defective wood.

EXHIBIT: WORK.

INJURY BY BARK AND WOOD-BORING GRUBS. ORDER COLEOPTERA, FAMILY BUPRESTIDÆ.

CASE 16.

56. The Western Hemlock Bark-Borer (*Melanophila drummondi* Kirby).

A medium-sized, flat-headed, bark-boring grub, excavating shallow, winding burrows through the inner layers of bark of living, injured, and recently felled western hemlock and Douglas spruce; California to northern and eastern Washington and western Idaho, and in the noble fir near Detroit, Oreg. A very common and destructive enemy, killing the largest and best trees, or causing serious "gum spot" defects in the wood of living ones.

EXHIBIT: Adult and work.

INJURY BY BARK-WEEVILS. ORDER COLEOPTERA, FAMILY CURCULIONIDÆ.

PART OF CASE 17.

57. The Sugar Pine Bark-Weevil (*Pissodes* sp.).

Adult snout-beetle deposits eggs in the outer bark of young living and injured sugar pine, producing small whitish grubs which mine through the inner bark and change to the adult in oval cavities excavated in the surface of the wood, causing the death or abnormal development of the trees. Grants Pass, Oreg.

EXHIBIT: Work.

58. The Douglas Spruce Twig-Weevil (*Curculionid*).

A small snout-beetle which deposits eggs in cavities in the bark of the small central shoots and terminal twigs of young, living Douglas spruce. The small whitish grubs mine through the inner bark and enter the pith to change to the adult, killing the twigs and causing a deformed development of the tree. St. Helen, Oreg.

EXHIBIT: Work.

59. The Pine Fungus-Gall Weevil (*Curculionid*).

A small snout-beetle breeding in the bark and wood of a common fungus gall on the shore pine and western yellow pine, causing the death of the branches and young trees. Newport, Oreg., and Moscow Mountains, Idaho.

EXHIBIT: Work.

INJURY TO DEAD WOOD AND BARK BY POWDER-POST BEETLES. ORDER COLEOPTERA, FAMILY PTINIDÆ.

PART OF CASE 17.

60. The Pine Wood Perforator (*Ptinid ?*).

Small white grubs burrow through the dead wood of western yellow-pine logs, causing rapid decay. Grants Pass, Oreg.

EXHIBIT: Work.

61. The Giant Arbor Vitæ Ptinid (*Ptinid*).

Small white grubs boring in the dead heartwood of living giant arborvitæ, contributing to the rapid decay of the heartwood. Port Angeles, Wash.

EXHIBIT: Work.

62. The Giant Arbor Vitæ Dryophilus (*Dryophilus* sp.).

A small whitish grub and brownish beetle, breeding in the outer bark of the giant arborvitæ. Its work is very common. Detroit, Oreg., and Port Angeles, Wash. "Represents a European family and genus heretofore unrecorded from North America." (Schwarz.)

EXHIBIT: Work.

INJURY TO TWIGS BY BARK MAGGOT. ORDER DIPTERA, FAMILY CECIDOMYIIDÆ.

PART OF CASE 17.

63. The Pine Twig Maggot (*Cecidomyiid*).

Minute reddish maggot, living in the bark of terminal twigs of the western yellow pine, causing the leaves to turn yellow and die. Moscow Mountains, Idaho. Common.

EXHIBIT: Work.

INJURY BY GALL INSECTS. ORDER HEMIPTERA, FAMILY APHIDIDÆ.

CASE 18.

64. The Sitka Spruce Gall-Louse (*Chermes sibiricus ?*).

A minute insect forming cone-like galls on the terminal twigs of the Sitka spruce at Newport, Oreg. Very common and injurious to young trees.

EXHIBIT: Work.

65. The Englemann Spruce Gall-Louse (*Chermes sibiricus ?*, var.).

Same habit as 64, but probably a variety or different species. Common on Englemann spruce at Sand Point, Idaho.

EXHIBIT: Work.

INJURY BY CICADA. ORDER HEMIPTERA, FAMILY CICADIDÆ.

CASE 18.

66. Small Western Cicada (*Cicada* sp.).

Injuring twigs of Douglas spruce, St. Helen, Oreg.

EXHIBIT: Adult and work.

INJURY BY TWIG-MINER. ORDER LEPIDOPTERA, FAMILY TORTRICIDÆ.

CASE 18.

67. The Pine Twig-Miner (*Tortricid*).

A caterpillar of a moth with similar habits to that of the pine moth of Nantucket, excavating burrows through the pith of the terminal twigs and shoots of young western yellow pine. Moscow Mountains, Idaho, where it was common and quite injurious.

EXHIBIT: Work.

INJURY BY BARK AND TWIG-BEETLES. ORDER COLEOPTERA. FAMILY SCOLYTIDÆ.

CASE 19.

68. The Balsam Fir Cryphalus (*Cryphalus* n. sp.).

Excavates irregular, broad, elongate egg chambers to one side of the entrance burrow in the bark and surface of wood, the larval galleries radiating in all directions and deeply grooved in the surface of the wood of the branches of dying and dead balsam fir. Shores and islands of Parmacheene Lake and Rump Mountain, Maine.

Exhibit: Work.

69. The Spruce Cryphalus (*Cryphalus* n. sp.).

Excavates broad transverse egg chambers in the bark and surface of wood; the larval galleries but slightly grooved in the surface of the wood of dying and dead red spruce and balsam fir. Islands and shores of Parmacheene Lake and near Portland, Me. Common in bark of small dying and dead red spruce.

Exhibit: Adult and work.

70. The Minute Oak Bark-Beetle (*Pityophthorus minutissimus* Zimm.).

Excavates two straight transverse galleries from a central entrance burrow and elongate longitudinal chamber in the bark and surface of wood of branches on living, dying, and felled trees, rarely in the thicker bark on the main trunk, of red oak, southern Maine, and other oaks in the eastern United States.

Exhibit: Adult and work.

71. The Minute Birch Bark-Beetle (*Pityophthorus* n. sp.).

Excavates galleries like that of the minute oak bark-beetle (70) in the living and dying bark of branches of the paper birch. Southern Massachusetts.

Exhibit: Adult and work.

72. The White Pine Twig-Beetle (*Pityophthorus* n. sp.).

Excavates several long, winding galleries from a central chamber in the bark; deeply grooved in the surface of the wood of small dying and broken branches of white pine. Camp Caribou, Maine.

Exhibit: Adult and work.

73. The Minute Spruce-Twig Wood-Engraver (*Pityophthorus* n. sp.).

Excavates a large central chamber and several curved galleries in the bark and deeply grooved in the surface of the wood of small branches of felled red spruce. Shores of Barkers Lake, Maine, and West Virginia.

Exhibit: Work.

74. The Spruce Wood-Engraver (*Pityophthorus cariniceps* Lec.).

Excavates many short, radiating, curved galleries from a large central chamber in the bark and surface of the wood of twigs and branches of dying trees and main stem of young, dying red spruce. Western Maine to Morgantown, W. Va., and Detroit, Mich.

Exhibit: Adult and work.

75. The Black Spruce Wood-Engraver (*Pityophthorus* n. sp.).

Excavates short longitudinal galleries from the entrance burrow in the bark and surface of wood of small, dying black spruce. Shores of Parmacheene Lake, northwestern Maine; Peakes Island, in Casco Bay, Maine, and Adirondacks, New York.

Exhibit: Adult and work.

76. The White Pine Wood-Engraver (*Pityogenes* n. sp.).

Excavates numerous short, radiating, curved egg galleries from a large central chamber in the bark and surface of wood of large and small branches and small, dying white pine. Northern Maine to West Virginia. Common. Heretofore recognized as *Pityophthorus sparsus* Lec.

EXHIBIT: Adult and work.

CASE 20.

77. The Small Red Spruce Bark-Beetle (*Dryocœtes* n. sp.).

Excavates three or four short, curved galleries from a small central cavity in the bark and surface of the wood of injured, dying, and recently felled red, white, and black spruce, Maine to northern New York, and the red spruce in the mountains of West Virginia. Common.

EXHIBIT: Adult and work.

78. The American Spruce Bark-Beetle (*Dryocœtes* n. sp.).

Excavates short, irregular galleries in the living bark of injured, dying, and recently felled red, white, and black spruce in Maine, spruce and pine in West Virginia; also in spruce and pine in Europe. Widely distributed in Europe and eastern North America.

EXHIBIT: Adult and work.

79. The Birch Bark-Beetle (*Dryocœtes* n. sp.).

Excavates irregular galleries in the bark of living, injured, and dying birch. Northwestern Maine and mountains of West Virginia. Common. Under favorable conditions causes the death of large trees.

EXHIBIT: Adult and work.

80. The Balsam Fir Bark-Beetle (*Tomicus balsameus* Lec.).

Excavates several radiating, curved, transverse galleries from a small central chamber in the living and dying bark of injured and dying balsam fir and red and black spruce. Western Maine; also recorded from northern Michigan and New York.

EXHIBIT: Adult and work.

81. The White Spruce Bark-Beetle (*Tomicus* n. sp.).

Excavates several long, radiating, longitudinal egg galleries from a large central chamber in the living bark of recently felled white spruce. Near Camp Caribou, northwestern Maine.

EXHIBIT: Adult and work.

82. The Hudson Bay Tomicus (*Tomicus* n. sp.).

Excavates one or two longitudinal primary galleries from a central burrow and small central chambers in the living bark of recently felled white and red spruce. Northwestern Maine; also recorded from Canada and British Columbia.

EXHIBIT: Adult and work.

CASE 21.

83. The Spruce Bark-Beetle (*Polygraphus rufipennis* Kirby).

Excavates three or four short, curved egg galleries from a large central chamber in the surface of the inner bark, through the bark and slightly grooving the surface of the wood of injured, declining, dying, and recently felled black, red, and white spruce, and rare in balsam fir. Very common throughout the northern and Appalachian spruce regions.

EXHIBIT: Adult and work.

84. The Cedar Bark-Beetle (*Phlœosinus dentatus* Lec.).

Excavates a single short longitudinal egg gallery from the entrance burrow and basal chambers, in the bark and surface of wood of injured and dying juniper and eastern arborvitæ. Eastern and northwestern United States and Canada. Common.

EXHIBIT: Adult and work.

86. The Parmacheene Bark-Beetle (*Xylochinus* n. sp.).

Excavates short, irregular egg galleries in the dead bark of small red spruce and balsam fir. Islands of Parmacheene Lake, Maine.

Exhibit: Work.

87. The Red Spruce Scolytus (*Scolytus* n. sp.).

Excavates two longitudinal egg galleries from a central entrance burrow and small lateral cavity in the living bark of branches of dying and recently felled red spruce. Northwestern Maine and Peak's Island, near Portland, Me.

Exhibit: Adult and work.

CASE 22.

88. The Minute Spruce Bark-Beetle (*Crypturgus atomus* Lec.).

Enters the galleries of other bark-beetles, from which it excavates numerous very small, irregular galleries through the inner bark of dying and dead black and red spruce and white pine. Northwestern Maine.

Exhibit: Adult and work.

89. The Spruce-Destroying Beetle (*Dendroctonus piceaperda* Hopk.).

Excavates long, longitudinal egg galleries from a basal entrance burrow in the bark, and grooving the wood of living and injured red and white spruce trees. Very destructive to the largest and best timber. Northern Maine to New York and New Brunswick. This is the great enemy of the red and white spruce of the northeastern spruce region, having caused the death and loss of a vast amount of timber. For methods of preventing losses, see Bulletin 28, n. s., Division of Entomology, U. S. Department of Agriculture.

Exhibit: Adult and work.

ENEMIES OF BARK-BEETLES. BIRDS AND INSECTS.

PART OF CASE 23.

90. Work of woodpeckers in spruce bark, when infested with the spruce-destroying beetle.

These birds are exceedingly beneficial in destroying the greatest enemy of the spruce.

Exhibit: Work.

91. The Cloudy Bark-Beetle Destroyer (*Thanasimus nubilus* Kl.).

The adults feed on the adults of the spruce-destroying and other bark-beetles, and its young or larvæ prey upon their developing broods. Very beneficial. The specimen of bark shows the pupa case of the Clerid in an egg gallery of the spruce-destroying beetle.

Exhibit: Adult and work.

92. Polyporus volvatus Peck.

A fungus growing from entrance and exit burrows of the spruce-destroying beetle in the bark, and the spruce-timber beetle in the wood, and from those of other bark and wood boring insects in dying and recently dead spruce trees killed by the spruce-destroying beetle in the Northeast, and the fir-destroying scolytus in the Northwest. The presence of this fungus usually indicates the destructive work of insects.

Exhibit: Work.

93. Parasitic Enemy of the Spruce-Destroying Beetle (*Bracon simplex* Cress).

The adult deposits eggs in the bark with the developing brood of the bark-beetle; the young maggot-like larvæ feed upon and kill the young. Very common and beneficial. Maine to West Virginia. Also attacks numerous other bark-infesting insects. The bark specimen shows the cocoon in which the matured larva develops to the adult.

Exhibit: Adult and work.

INJURY BY BARK AND WOOD BORING GRUBS. ORDER COLEOPTERA, FAMILIES BUPRESTIDÆ, CERAMBYCIDÆ, AND MELANDRYIDÆ.

CASE 24.

94. Buprestid.
Work of flat-headed bark and wood miner in wood of dying balsam fir.
Exhibit: Work.

95. The Destructive Spruce-Wood Borer (*Tetropium cinnamopterum* Kirby).
A slender, round-headed, bark and wood boring grub which excavates winding barrows through the inner bark and surface of the wood, then enters the sapwood and changes to the adult. Infests slightly injured, declining, and recently felled red, black, and white spruce. Maine to West Virginia. Common, and very destructive to the wood of dying trees, and may also cause the death of slightly injured ones.
Exhibit: Adult and work.

96. The Cedar Tree Borer (*Hylotrupes ligneus* Fab.).
A slender, whitish, bark and wood boring grub, excavating winding burrows in the bark and surface of the wood of living arborvitæ, causing the death of the trees, and serious defects in the wood of living ones. Common in northwestern Maine.
Exhibit: Adult and work.

97. The Blazed-Tree Borer (*Serropalpus varbatus* Schall).
A slender, whitish, wood-boring grub, which enters at wounds on living trees and bores deep into the sapwood and heartwood, causing a rapid decay of the infested parts. Common in "blazed" wounds on balsam fir and spruce trees along the trails in northwestern Maine.
Exhibit: Work.

98. The Mountain Ash Borer (*Saperda* sp.).
A destructive enemy of the mountain ash, boring in the healthy wood of the main stem. Northwestern Maine.
Exhibit: Work.

SECTION II.

INSECT ENEMIES OF FORESTS IN GENERAL.

INJURING THE FOLIAGE.

CATERPILLARS OF BUTTERFLIES AND MOTHS. ORDER LEPIDOPTERA.

CASE 25.

99. The Violet-Tip Butterfly (*Grapta interrogationis* Fab.).
Larvæ on elm.
Exhibit: Adults, larva.

100. The Mourning Cloak Butterfly (*Euranessa antiopa* Linn.).
Larvæ on foliage of elm, willow, and poplar, sometimes defoliating trees.
Exhibit: Adults, larvæ and pupa.

101. The Viceroy Butterfly (*Basilarchia archippus* Cram.).
Larvæ on willow and poplar.
Exhibit: Adult.

102. The Buff-Tipped Butterfly (*Limenitis bredowii* Hüb.).
Larvæ on oak in California.
Exhibit: Adult.

103. The Common Hackberry Butterfly (*Chlorippe celtis* Bd. & Lec.).
Larvæ on hackberry.
Exhibit: Adult, pupa.

104. The Pine Butterfly (*Neophasia menapia* Feld.).
Larvæ defoliate pine in the Pacific States.
Exhibit: Adults.

105. The Locust Leaf Folder (*Epargyreus* (*Eudamus*) *tityrus* Fab.).
Larvæ on locust.
Exhibit: Adults, larva, pupa, cocoon.

106. The Walnut Sphinx (*Cressonia juglandis* S. & A.).
Larvæ on hickory and walnut.
Exhibit: Adults.

107. The Pine Sphinx (*Lapara coniferarum* S. & A.).
Larvæ on pine in the Eastern States.
Exhibit: Adults, larva.

108. The Catalpa Sphinx (*Ceratomia catalpæ* Bd.).
The larvæ feed upon and frequently defoliate catalpa wherever this tree is native.
Exhibit: Adult, larva.

109. The Wavy Ash Sphinx (*Ceratomia undulosa* Walk.).
Larvæ on ash.
Exhibit: Adult, larva.

110. The Ash Sphinx (*Hyloicus kalmiæ* S. & A.).
Larvæ on ash in the Eastern States.
Exhibit: Adult.

CASE 26.

111. The Four-Horned Sphinx (*Ceratomia amyntor* Hüb.).
Larvæ on elm.
Exhibit: Adults, larva.

112. The Western Poplar Sphinx (*Pachysphinx modesta* var. *occidentalis* Hy. Edw.).
Larvæ on poplar in the Western States.
Exhibit: Adult.

113. The Polyphemus Moth (*Telea polyphemus* Cram.).
The large green larvæ occur on maple, oak, birch, and a variety of other forest trees.
Exhibit: Adult.

114. The Hickory Horned Devil (*Citheronia regalis* Hüb.).
Larvæ on hickory and walnut.
Exhibit: Adults, larva.

115. The Imperial Moth (*Basilona imperialis* Dru.).
The larvæ feed upon pine and many other species of coniferous and deciduous trees.
Exhibit: Adults, larva, pupa.

116. The Orange-Striped Oak Worm (*Anisota senatoria* Hübn.).
The larvæ defoliate oak in the Eastern States.
Exhibit: Adults, larvæ, pupæ.

117. The Spiny Oak Worm (*Anisota stigma* Hübn.).
Larvæ in large colonies on oak, sometimes defoliating trees. Eastern States.
Exhibit: Adults, larvæ, pupæ.

CASE 118.

118. The Green-Striped Maple Worm (*Anisota rubicunda* Fab.).
Larvæ in colonies on maple, sometimes defoliating trees. Eastern States.
EXHIBIT: Adults, eggs, larvæ, pupæ.

119. The Buck Moth (*Hemileuca maia* Dru.).
The black spiny larvæ feed in colonies on oak. Eastern States.
EXHIBIT: Adults.

120. The Pale Tussock Caterpillar (*Halisidota tessellaris* Harris).
The pale-yellow, black tufted larvæ feed on elm, sycamore, maple, walnut, oak, etc.
EXHIBIT: Adults.

121. The Pine Tussock Caterpillar (*Euschausia argentata* Pack.).
The larvæ feed in colonies on pine, cedar, Douglas spruce, etc. Northwestern States.
EXHIBIT: Adults, pupæ, cocoon, work.

122. The Hickory Tussock Caterpillar (*Halisidota caryæ* Harris).
The white wooly caterpillars, tufted with black, feed in large colonies on hickory, walnut, elm, and other forest trees, sometimes becoming very destructive. Eastern States.
EXHIBIT: Adults, cocoons.

123. The Oak Tussock Caterpillar (*Halisidota maculata* Harris).
The orange and black tufted larvæ on oak, elm, alder, etc. Northern States.
EXHIBIT: Adults.

124. The Fall Web-Worm (*Hyphantria textor* Harris).
Larvæ construct large tents on most species of deciduous forest trees. At times very destructive.
EXHIBIT: Adults, larvæ, pupa.

125. The American Dagger-Moth (*Apatela americana* Harr.).
The larvæ occur on maple, elm, and a variety of other forest trees.
EXHIBIT: Adults, larva.

126. The Smeared Dagger-Moth (*Apatela oblinita* S. & A.).
Larvæ occur on nearly all varieties of deciduous trees.
EXHIBIT: Adults, larvæ.

CASE 28.

127. The Underwing Moths (Genus *Catocala*).
The large gray larvæ of these moths, of which there are many species in the United States, are nocturnal in habit, and conceal themselves during the day in the crevices of the bark on tree trunks and limbs. They devour the foliage of oak, hickory, walnut, poplar, birch, and other species of forest trees.
EXHIBIT: Adults of the following species: *Catocala retecta* Grote, *Catocala vidua* S. & A., *Catocala obscura* Strk., *Catocala cerogama* Guen., *Catocala unijuga* Walk., *Catocala concumbens* Walk., *Catocala cara* Guen.

128. The Semi-Looping Maple Worm (*Homoptera lunata* Dru.).
The slender green larvæ occur on maple, willow, etc.
EXHIBIT: Adults, larva, pupa.

129. The California Phryganidia (*Phryganidia californica* Pack.).
Larvæ on oak, sometimes defoliating trees in California.
EXHIBIT: Adults, larvæ.

130. The Poplar Tent-Maker (*Melalopha inclusa* Hübn.).
Larvæ construct small tents on poplar and willow. Eastern States.
EXHIBIT: Adults, larva.

131. The Black Hickory Caterpillar (*Datana integerrima* G. & R.).
Larvæ in colonies on hickory and walnut, sometimes defoliating the trees. Eastern States.
Exhibit: Adult, larva, pupæ.

132. The Yellow-Necked Apple-Tree Caterpillar (*Datana ministra* Dru.).
Larvæ in colonies on birch, oak, and other forest trees, as well as on apple. Eastern States.
Exhibit: Adults, eggs, larvæ, pupa.

133. The Striped Hickory Caterpillar (*Datana angusii* G. & R.).
Larvæ in colonies on hickory and oak. Eastern States.
Exhibit: Adults.

134. The Green Oak Caterpillar (*Nadata gibbosa* S. & A.).
Larvæ on oak, maple, and other forest trees.
Exhibit: Adult, larvæ.

135. The Rosy Hyparpax (*Hyparpax aurora* S. & A.).
Larvæ on oak in the Eastern States.
Exhibit: Adults.

CASE 29.

136 The Red-Humped Oak Caterpillar (*Symmerista albifrons* S. & A.).
Larvæ on oak, sometimes defoliating trees in the Eastern States.
Exhibit: Adults, larva, pupa.

137. The Rusty Tussock-Moth (*Notolophus antiqua* Linn.).
Larvæ on most species of deciduous forest trees in America and Europe.
Exhibit: Adults.

138. The California Tussock-Moth (*Hemerocampa vetusta* Bd.).
Larvæ on various species of deciduous forest trees in California.
Exhibit: Adults, larva.

139. The White-Marked Tussock-Moth (*Hemerocampa leucostigma* S. & A.).
Larvæ sometimes defoliate elm, maple, and other deciduous forest trees in the Eastern States.
Exhibit: Adults, egg-mass, larva, cocoon.

140. The Dark Tussock-Moth (*Olene achatina* S. & A.).
Larvæ on various deciduous forest trees in the Eastern States.
Exhibit: Adult.

141. The Brown-Tailed Moth (*Euproctis chrysorrhœa* Linn.).
Introduced from Europe and destructive to deciduous forest trees in Massachusetts and New Hampshire.
Exhibit: Adults.

142. The Gypsy Moth (*Porthetria dispar* Linn.).
Introduced from Europe and very destructive to nearly all deciduous and a few coniferous forest trees in Massachusetts.
Exhibit: Adults, larvæ.

143. The Forest Tent-Caterpillar (*Malacosoma* (*Clisiocampa*) *disstria* Hübn.).
Larvæ at times very destructive to maple, oak, poplar, gum, and nearly all other deciduous forest trees throughout the United States.
Exhibit: Adults, eggs, larvæ, pupa, cocoons.

144. The Tufted Tent-Caterpillar (*Malacosoma* (*Clisiocampa*) *constricta* Stretch).
Larvæ on oak in California.
Exhibit: Adults, eggs, larvæ.

145. The American Tent-Caterpillar (*Malacosoma* (*Clisiocampa*) *americana* Fab.).

Larvæ principally destructive to fruit trees, but also to cherry and a few other forest trees in the Eastern States.

Exhibit: Adults, eggs.

146. The Rocky Mountain Tent-Caterpillar (*Malacosoma* (*Clisiocampa*) *fragilis* Stretch.).

Larvæ feed on deciduous forest trees generally and are at times very destructive. Rocky Mountain States.

Exhibit: Adults, eggs, larvæ.

147. The Northwestern Tent-Caterpillar (*Malacosoma* (*Clisiocampa*) *pluvialis* Dyar.).

Larvæ on most species of deciduous forest trees in the Northwestern States.

Exhibit: Adults, larva, cocoon.

148. The Californian Tent-Caterpillar (*Malacosoma* (*Clisiocampa*) *californica* Pack.).

Larvæ on oak in California.

Exhibit: Adults, larva.

149. The Spring Canker-Worm (*Paleacrita vernata* Harr.).

The larvæ feed upon the surface of the leaves of various forest and shade trees; especially upon elm in the Eastern States.

Exhibit: Adults, pupa.

CASE 30.

150. The Cherry-Leaf Web-Worm (*Calocalpe undulata* Linn.).

The larvæ live in webs on the terminal shoots of black cherry.

Exhibit: Adults, work.

151. The Western Oak Span-Worm (*Therina somniaria* Hulst.).

The larvæ occur on oak in the Northwestern States, sometimes defoliating trees.

Exhibit: Adults, pupæ.

152. The Large Forest Span-Worm (*Sabulodes transversata* Dru.).

Larvæ occur on maple, poplar, oak, etc.

Exhibit: Adults, larva.

153. The Crinkly Flannel Moth (*Lagoa crispata* Pack.).

The larvæ, which somewhat resemble the slug caterpillars, feed upon oak, poplar, and a variety of other deciduous trees.

Exhibit: Adults.

154. The Oak Web-Worm (*Archips* (*Cacœcia*) *fervidana* Clem.).

Larvæ live in colonies on oak, sheltered by a web inclosing leaves and a mass of excrement.

Exhibit: Adults.

155. The Slug Caterpillars (Family *Cochlidiidæ*.).

These bright-colored slug-like larvæ feed very generally on foliage of most deciduous trees.

Exhibit: the following species: *Sibine stimulea* Clem., adults, larva, cocoon; *Euclea delphinii* Bdv., adult; *Euclea indetermina* Bdv., adult.

THE FALSE CATERPILLARS OR SAWFLIES. FAMILY TENTHREDINIDÆ.

PART OF CASE 31.

156. Abbott's White-Pine Sawfly (*Lophyrus abbotti* Leach).

This species, together with several closely allied forms, is at times very destructive to pine.

Exhibit: Adults, larvæ, cocoons.

157. The Larch Sawfly (*Nematus erichsonii* Hartig).

One of the most destructive forest insects; the larvæ at various times past entirely defoliated the larch throughout the Northeastern States and caused the death of a large proportion of the trees.

Exhibit: Adults.

158. The Large American Sawfly (*Cimbex americana* Leach).

Larvæ destroy foliage of elm, willow, poplar, and linden.

Exhibit: Adult.

MISCELLANEOUS FOLIAGE INSECTS.

PART OF CASE 31.

159. The Common Walking Stick (*Diapheromera femorata* Say).

Young and adults devour foliage of deciduous forest trees.

Exhibit: Adult.

160. The Katydid (*Microcentrum laurifolium* Linn.).

Young and adults feed on foliage of trees.

Exhibit: Adult, eggs.

LEAF-BEETLES. FAMILY SCARABÆIDÆ.

161. The Rhinoceros Beetle (*Dynastes tityus* Linn.).

Larvæ mine in decaying stumps; adults destroy foliage of ash.

Exhibit: Adults.

162. The Goldsmith Beetle (*Cotalpa lanigera* Linn.).

Adults on oak, poplar, and other deciduous trees, sometimes defoliating them.

Exhibit: Adults.

THE LEAF-BEETLES. FAMILY CHRYSOMELIDÆ.

PART OF CASE 31.

163. The Imported Elm Leaf-Beetle (*Galerucella luteola* Müll.).

A very serious enemy to the elm in the Eastern States.

Exhibit: Adults, work.

164. The Larger Elm Leaf-Beetle (*Monocesta coryli* Say).

Adults and larvæ destroy foliage of elm in sections of the Middle West.

Exhibit: Adults, work.

165. The Striped Willow Leaf-Beetle (*Melasoma scripta* Fab.).

Both larvæ and adults feed on foliage of poplar and willow, and are at times very destructive to these trees. An especial enemy of the osier willow industry.

Exhibit: Adults, pupæ.

166. The Spotted Willow Leaf-Beetle (*Melasoma lapponica* Linn.).

Habits similar to the above, but less abundant and injurious.

Exhibit: Adults.

INJURING THE FRUIT.

THE WEEVILS. FAMILY CURCULIONIDÆ.

PART OF CASE 31.

167. The Nut Weevils (Genus *Balaninus*).

There are numerous species, the larvæ of which live within acorns and nuts of various sorts.

Exhibit: Adults of the following species: *Balaninus nasicus* Say, *Balaninus carya* Horn, *Balaninus quercus* Horn.

168. The Walnut Fruit Weevil (*Conotrachelus juglandis* Lec.).

The larvæ live in green fruit of walnut.

Exhibit: Adults.

CONE AND NUT WORMS. ORDER LEPIDOPTERA.

PART OF CASE 31.

169. The Hickory Husk-Worm (*Grapholitha caryana* Fitch).

The larvæ live within the immature nuts and husks of the hickory and pecan.

Exhibit: Adults, work.

170. The Spruce Cone-Worm (*Pinipestis reniculella* Grt.).

Larvæ attack cones of spruce.

Exhibit: Adult, work.

171. The Southern Pine Cone-Worm.

An insect closely allied to the spruce cone-worm which attacks the cone of the Southern long-leaf pine.

Exhibit: Work.

INJURING THE TWIGS AND SMALLER BRANCHES.

THE CICADAS. FAMILY CICADIDÆ.

PART OF CASE 31.

172. The Seventeen-Year Cicada (*Tibicen septendecim* Linn.).

The most destructive species, but owing to the long period required by the young to reach maturity only injurious some years.

Exhibit: Adults, pupa, work.

THE SCALE INSECTS. FAMILY COCCIDÆ.

PART OF CASE 31.

173. The Cottony Maple Scale (*Pulvinaria innumerabilis* Rath.).

Becomes at times very abundant on twigs of maple.

Exhibit: Adult scales on twigs.

174. The Gloomy Maple Scale (*Aspidiotus tenebricosus* Comst.).

At times very abundant on maple. Principally injurious to shade trees in the neighborhood of towns.

Exhibit: Adult scales on bark.

175. The Hickory Soft Scale (*Lecanium* sp.).

At times abundant on hickory and pecan in the Southern States.

Exhibit: Adult scales on twigs.

THE TWIG WEEVILS. FAMILY CURCULIONIDÆ.

PART OF CASE 32.

176. The Western Spruce Weevil (*Pissodes* sp.).

Attacks and kills the terminal shoots of Sitka spruce, causing deformed trees. Northwestern States.

EXHIBIT: Adults, larvæ, work.

177. The White-Pine Weevil (*Pissodes strobi* Peck.).

Attacks and kills the terminal shoots of white pine, spruce, and deodar, causing serious deformity to the tree; also breeds in the bark of the lower portions of the trunk of pines and spruce, hastening the death of injured trees. Eastern States.

EXHIBIT: Adults, work. Sections of young white pine showing nature of injury to terminal shoots. (Large case.)

ROUND-HEADED BORERS. FAMILY CERAMBYCIDÆ.

PART OF CASE 32.

178. The Oak Pruner (*Elaphidion villosum* Fab.).

The larvæ bore in twigs of living oak, hickory, etc., causing them to break and fall.

EXHIBIT: Adults, work.

179. The Hickory Twig Girdler (*Oncideres cingulata* Say).

The adult girdles the twigs of oak, hickory, persimmon, and other trees, sometimes so extensively as to cause serious injury.

EXHIBIT: Adults, work, figure.

INJURING THE INNER BARK AND SAPWOOD.

THE BARK WEEVILS. FAMILY CURCULIONIDÆ.

CASE 33.

180. The Cypress Weevil (*Eudocimus mannerheimii* Boh.).

The adults feed on the bark of bald-cypress twigs, causing their death, and the larvæ mine the inner bark of injured and recently felled trees. Southern States.

EXHIBIT: Adult, larva, work.

181. The Pales Weevil (*Hylobius pales* Hbst.).

The larvæ bore into the inner bark of stumps and roots of recently felled, dying, and injured pine. Eastern States.

EXHIBIT: Adults.

182. The Pitch-Eating Weevil (*Pachylobius picivorus* Germ.).

Has habits similar to the pales weevil. Eastern States.

EXHIBIT: Adults.

183. The Walnut Weevil (*Cryptorhynchus parochus* Hbst.).

The larvæ mine the inner bark and sapwood of weakened and recently dead walnut.

EXHIBIT: Adults, work.

184. The Fir Weevil (*Pissodes dubius* Rand.).

The larvæ mine the inner bark of balsam fir, hastening the death of injured trees. Northeastern States.

EXHIBIT: Adults, larvæ, work.

THE ROUND-HEADED BORERS. FAMILY CERAMBYCIDÆ.

CASE 34.

185. The White-Pine Sawyer (*Monohammus scutellatus* Say).

Larvæ mine the inner bark and bore deep into the sapwood of white and silver pine, hastening the death of dying trees and injuring saw logs.

Exhibit: Adults, work.

186. The Common Pine Sawyer (*Monohammus confusor* Kirby).

The larvæ mine the inner bark and bore large holes into the sapwood of dying trees and saw logs of pine and spruce.

Exhibit: Adults, larva.

187. The Ponderous Pine-Borer (*Ergates spiculatus* Lec.).

Larvæ bore in dead pine logs, injuring them for timber. Northwestern States.

Exhibit: Adults, larva, work.

188. The Knob-Horned Pine-Borer (*Acanthocinus nodosus* Fab.).

The larvæ mine the inner bark of pine stumps and large logs.

Exhibit: Adults.

189. The Obsolete Pine-Borer (*Acanthocinus obsoletus* Oliv.).

The larvæ mine the inner bark of freshly killed pine.

Exhibit: Adults.

190. The Small Pine Bark-Borer (*Ceratographis pusillus* Kirby).

Larvæ mine the inner bark of dead and dying pine.

Exhibit: Adults.

191. The Lesser Pine Borer (*Asemum mœstum* Hald.).

Larvæ bore into sapwood of dead pine and spruce logs and stumps. Eastern States.

Exhibit: Adults.

CASE 35.

192. The Poplar Borer (*Saperda calcarata* Say).

Larvæ bore in trunks of living poplar, cottonwood, and willow, causing great destruction to these trees.

Exhibit: Adults, work.

193. The Common Elm-Tree Borer (*Saperda tridentata* Oliv.).

The larvæ mine the bark and sapwood of dead, dying, and healthy elm, often causing great destruction.

Exhibit: Adults, work.

194. The Poplar Girdler (*Saperda concolor* Lec.).

Larvæ mine in green bark of poplar saplings, girdling the trunks and causing large swellings; also attack willow.

Exhibit: Adults, work.

195. The Sugar Maple Borer (*Plagionotus speciosus* Say).

Larvæ mine the inner bark and sapwood of recently dead, dying, and living maple, often causing the death of weakened trees.

Exhibit: Adults.

196. The Locust Borer (*Cyllene robiniæ* Forst.).

Larvæ mine the wood and bark of living black locust, causing great damage and destruction.

Exhibit: Adults, work.

197. The Linden Borer (*Saperda vestita* Say).
Larvæ mine the inner bark and bore into the trunk of linden, causing much injury.
Exhibit: Adults, work.

198. The Chestnut Callidium (*Callidium æreum* Newm.).
Larvæ mine inner bark of chestnut, hastening, and perhaps causing, death of aged or injured trees.
Exhibit: Adults, larvæ, pupa.

199. The Belted Chion (*Chion cinctus* Dru.).
The larvæ mine the inner bark and bore into the wood of trunk and branches of dying and recently dead hickory, chestnut, oak, etc.
Exhibit: Adults, larva, work.

200. The Dusty Oak Borer (*Romaleum atomarium* Dru.).
Larvæ in stumps and logs of recently dead oak.
Exhibit: Adults.

CASE 36.

201. The Beautiful Hickory Borer (*Goes pulchra* Hald.).
Larvæ bore in hickory.
Exhibit: Adults.

202. The Tiger Hickory Borer (*Goes tigrina* DeG.).
Larvæ mine the inner bark and sapwood of living hickory and oak.
Exhibit: Adults.

203. The White-Lined Cypress Borer (*Physocnemum andreæ* Hald.).
Larvæ mine the inner bark and outer sapwood of cypress logs. Southern States.
Exhibit: Adults, larva, work.

204. The Common Hickory Borer (*Saperda discoidea* Fab.).
Larvæ mine the inner bark of injured, dying, and recently dead hickory.
Exhibit: Adults.

205. The Blue-Winged Walnut Borer (*Gaurotes cyanipennis* Say).
Larvæ infest walnut.
Exhibit: Adults.

206. The Lichen-like Beetle (*Leptostylus aculiferus* Say).
Larvæ mine the inner bark of dying and dead tulip (*Liriodendron*).
Exhibit: Adults.

207. The Ash-Colored Mulberry Borer (*Hetœmis cinerea* Oliv.).
Adults feed on the foliage and larvæ mine the green bark and sapwood of dying and injured mulberry.
Exhibit: Adults.

208. The Painted Hickory Borer (*Cyllene picta* Dru.).
Larvæ bore in the trunks of dead, dying, and sometimes healthy hickory trees.
Exhibit: Adults.

CASE 37.

209. The Curious Cypress Borer (*Curius dentatus* Newm.).
Larvæ mine the smaller branches of young bald cypress.
Exhibit: Adults, work.

210. The Banded Ash Borer (*Neoclytus capræa* Say).
Larvæ very injurious to dying trees and saw logs of black ash, boring numerous holes through the wood.
Exhibit: Adults, work.

211. The Rigid Cypress Borer (*Eme rigida* Say).
Larvæ mine inner bark of girdled cypress and dying cedar.
Exhibit: Adult, larva, work.

212. The Southern Oak Borer (*Mallodon dasystomus* Say).
Larvæ bore in healthy live-oak, hackberry, and hickory trees, greatly injuring them. Southern States.
Exhibit: Adults.

213. The Live-Oak Root-Borer (*Mallodon melanopus* Linn.).
Larvæ bore into the roots of young oaks, causing dwarfed and worthless trees. Southern States.
Exhibit: Adult.

214. The Variable Oak Borer (*Phymatodes variabilis* Fab.).
Larvæ mine inner bark of dying and recently dead oak; are also injurious to tan bark.
Exhibit: Adult, work.

215. The Thunderbolt Beetle (*Arhopalus fulminans* Fab.).
Larvæ mine the inner bark and sapwood of chestnut and oak.
Exhibit: Adults.

216. The Lesser Prionus (*Orthosoma brunneum* Forst.).
Larva in decaying logs and stumps of nearly all forest trees.
Exhibit: Adults.

217. The Cottonwood Root-Borer (*Plectrodera scalator* Fab.).
Larvæ in roots of poplar and cottonwood.
Exhibit: Adults.

218. The Broad-Necked Prionus (*Prionus laticollis* Dru.).
Larvæ in roots of oak and poplar. Sometimes destructive. Also in stumps of pine.
Exhibit: Adults.

CASE 38.

219. The Destructive Spruce Wood-Borer (*Tetropium cinnamopterum* Kirby).
Larvæ mine green bark and wood of injured and dying spruce, hastening death and promoting decay.
Exhibit: Adults, larvæ, work.

220. The Wavy Spruce Borer (*Xylotrechus undulatus* Say).
Larvæ mine the inner bark and sapwood of Douglas spruce, fir, and hemlock.
Exhibit: Adults.

221. The Canadian Leptura (*Leptura canadensis* Fab.).
Larvæ mine sapwood of dead spruce and hemlock, inducing rapid decay.
Exhibit: Adults.

222. The Red-Headed Clytus (*Neoclytus erythrocephalus* Fab.).
Larvæ mine in dead and dying bark and sapwood of a great variety of forest trees, maple, ash, hickory, sweet-gum, cypress, etc.
Exhibit: Adults.

223. The Ribbed Pine Borer (*Rhagium lineatum* Oliv.).
Larvæ mine the inner bark of dying and dead pine, spruce, and some other conifers.
Exhibit: Adults, larvæ, pupa, work.

224. The Black-Horned Pine Borer (*Callidium antennatum* Newm.).
Larvæ mine inner bark and wood of dying and dead pine, cedar, etc.
Exhibit: Adults, work.

225. The Four-Marked Ash Borer (*Eburia quadrigeminata* Say).
Larvæ invest ash and hickory.
Exhibit: Adults.

226. The Cedar Borer (*Hylotrupes ligneus* Fab.).
Larvæ mine inner bark and sapwood of cedar, causing the death of the trees.
Exhibit: Adults, larvæ pupa, work.

227. The Banded Urographis (*Urographis fasciatus* Horn).
The larvæ mine the inner bark of dead oak, maple, chestnut, sweet-gum, hickory, walnut, sourwood, dogwood, and probably nearly all deciduous trees. Eastern States.
Exhibit: Adults.

228. The Rustic Borer (*Xylotrechus colonus* Fab.).
Larvæ mine the inner bark and sapwood of recently cut or dying oak, chestnut, hickory, maple, and other hard woods.
Exhibit: Adults.

THE FLAT-HEADED BORERS. FAMILY BUPRESTIDÆ.

CASE 39.

229. The Bronze Birch Borer (*Agrilus anxius* Gory).
The larvæ mine the inner bark of living and injured birch and poplar. Very destructive in the Northern States.
Exhibit: Adults, work.

230. The Two-Lined Chestnut Borer (*Agrilus bilineatus* Web.).
The slender larvæ mine the inner bark of recently dead, injured, and healthy chestnut and oak. One of the principal causes for the wholesale destruction of chestnut in the Southern States.
Exhibit: Adults, work.

231. The Eastern Hemlock Bark-Borer (*Melanophila fulvoguttata* Harr.).
Larvæ mine the inner bark of recently dead and injured hemlock in the Eastern States.
Exhibit: Adults, work.

232. The Flat-Headed Apple-Tree Borer (*Chrysobothris femorata* Fab.).
The larvæ mine the inner bark of recently dead and injured oak, chestnut, hickory, maple, and some other deciduous forest trees. Eastern States.
Exhibit: Adults, larvæ, pupæ, work.

CASE 40.

233. The Flat-Headed Pine Bark-Borer (*Chrysobothris dentipes* Germ.).
Larvæ mine the inner bark of recently dead and dying pine.
Exhibit: Adults.

234. The Flat-Headed Hickory Borer (*Dicerca obscura* Fab.).
Larvæ bore into the trunk and limbs of hickory, maple, and some other deciduous trees.
Exhibit: Adults.

235. The Western Hemlock Bark-Borer (*Melanophila drummondi* Kirby).
The larvæ mine the inner bark of dead and healthy hemlock and Douglas spruce, causing defects in the lumber and killing trees. Northwestern States.
Exhibit: Adults, larva, pupa, work.

INJURING THE WOOD.

THE FLAT-HEADED BORERS. FAMILY BUPRESTIDÆ.

PART OF CASE 40.

236. The Turpentine Borer (*Buprestis apricans* Hbst.).

The larvæ bore into the solid resinous heartwood of long-leafed pine after "boxing" by turpentine workers, so weakening the trunk as to cause it to break and spoiling portions of it for lumber.

Exhibit: Adult, work.

237. The Golden Buprestis (*Buprestis aurulenta* Linn.).

Larvæ bore into trunks of dead pine, spruce, fir, and other conifers.

Exhibit: Adults.

238. The Heart-wood Pine Borer (*Chalcophora virginiensis* Dru.).

Larvæ bore into trunks of dead pine and spruce and into heartwood of living trees.

Exhibit: Adults, work.

WALL CASE.

239. The Cypress Sapwood Borer (*Acmæodera pulchella* Hbst.).

Larvæ mine the sapwood of girdled cypress several years after death.

Exhibit: Work. Cypress board showing injury to the sapwood (large case).

THE TIMBER BEETLES. FAMILY SCOLYTIDÆ.

PART OF CASE 41.

240. The Hickory Timber-Beetle (*Xyleborus celsus* Eich.).

The adults excavate long branching galleries in dying trees and logs of hickory.

Exhibit: Adults, work.

WALL CASE.

241. The Pan-American Platypus (*Platypus compositus* Say).

The adults bore into the sapwood and sometimes into the heartwood of dying hardwoods and coniferous trees of numerous species.

Exhibit: Work. Boards from girdled cypress showing pin-hole defects caused by the galleries.

THE POWDER-POST BEETLES. FAMILY PTINIDÆ.

PART OF CASE 41.

242. The Red-Shouldered Ptinid Borer (*Sinoxylon basilare* Say).

Adult bores short curved galleries in branches of dead hickory, persimmon, and most other deciduous trees; the larvæ bore the solid wood.

Exhibit: Adults, work.

243. Powder-Post Beetles (Genus *Lyctus*).

Exhibit: Work, sections of seasoned ash and hickory showing characteristic injury by the beetles and larvæ. (Large case.)

THE TIMBER WORMS. FAMILIES BRENTHIDÆ AND LYMEXYLIDÆ.

PART OF CASE 41.

244. The Northern Brenthis (*Eupsalis minuta* Dru.).

The larvæ excavate extensive galleries in solid wood of recently dead and dying oak, chestnut, beach, elm, cypress, and most other species of deciduous forest trees.

Exhibit: Adults, work.

245. The Chestnut Timber Worm (*Lymexylon sericeum* Harr.).
The larvæ excavate extensive galleries in the heartwood and sapwood of living and dead chestnut and oak.
Exhibit: Adult, work.

THE CARPENTER WORMS. ORDER LEPIDOPTERA. FAMILY COSSIDÆ.

CASE 42.

246. The Leopard Moth (*Zeuzera pyrina* Fab.).
An introduced species very injurious to forest, shade, and orchard trees in the vicinity of New York City.
Exhibit: Adults, larvæ, pupa, work.

247. The Oak Carpenter Worm (*Prionoxystus robiniæ* Peck).
The larvæ mine in living oak and locust and are sometimes very destructive, especially to aged trees.
Exhibit: Adults, work.

248. The Poplar Carpenter Worm (*Cossus centerensis* Lint.).
The larvæ mine in trunks of poplar.
Exhibit: Adults.

THE HORNTAILS OR WOOD WASPS. FAMILY UROCERIDÆ.

CASE 43.

249. The Pigeon Tremex (*Tremex columba* Linn.).
Larvæ mine the sapwood of hickory, oak, poplar, maple, and other deciduous forest trees, hastening the death of those weakened by other causes.
Exhibit: Adults, work.

250. The Pale Tremex (*Tremex sericeus* Say).
Habits like the pigeon tremex.
Exhibit: Adults.

251. The White-Horned Horntail (*Urocerus albicornis* Fabr.).
Attacks spruce, hemlock, and fir.
Exhibit: Adults, larva, pupa, work.

252. The Blue Horntail (*Paururus cyaneus* Fab.).
Attacks spruce and fir.
Exhibit: Adult.

253. The Banded Horntail (*Urocerus abdominalis* Harris).
Attacks spruce.
Exhibit: Adults.

254. The Yellow-Winged Horntail (*Urocerus flavipennis* Kirby).
Attacks spruce.
Exhibit: Adults.

255. The Small-Pine Horntail (*Paururus pinicola* Ashm.).
Larvæ in pine.
Exhibit: Adults.

256. The Black-Pine Horntail (*Paururus hopkinsi* Ashm.).
Larvæ in pine.
Exhibit: Adults.

PARASITIC ENEMIES. FAMILY ICHNEUMONIDÆ.

PART OF CASE 43.

257. The Lunated Long-Sting (*Thalessa lunator* Fab.).

There are several quite similar species of these insects, which by means of the long, thread-like appendage to the body, deposit their eggs within the galleries of the horntail larvæ upon which their own larvæ are parasitic.

EXHIBIT: Adults.

INJURING INNER BARK.

THE BARK-BEETLES. FAMILY SCOLYTIDÆ.

CASE 44.

258. The Pine-Destroying Beetle of the Black Hills (*Dendroctonus ponderosæ* Hopk.).

Attacks healthy pine and spruce in the Black Hills of South Dakota, and Rocky Mountain region. The adult beetles excavate characteristic galleries in the inner bark of dead, dying, and healthy trees. Their eggs are deposited along the sides of these galleries, and the larvæ developing from them mine the inner bark. It is estimated that it has been the primary cause of the destruction of 1,000,000,000 feet of bull pine (*Pinus ponderosa*) in the Black Hills.

EXHIBIT: Adults, work. Sections of trunks of western yellow pine attacked by beetles showing pitch tubes on surface and marks of galleries in inner bark. (Large case.)

CASE 45.

259. The Destructive Pine Bark-Beetle (*Dendroctonus frontalis* Zimm.).

Attacks healthy pine and spruce in the Southern States. It is capable of enormous destruction and, though usually held in check by natural causes, has at various times past so increased as to seriously menace the entire stand of pine and spruce in portions of the Southeastern States, notably in West Virginia in 1891–92.

EXHIBIT: Adults, work. Markings on surface of wood of beetle-killed tree; appearance of outer bark of beetle-killed trees; outer bark of tree scaled off by woodpeckers in search of beetles and their larvæ. (Large case.)

260. The Oregon Tomicus (*Tomicus oregoni* Eich.).

A secondary enemy of pine, attacking and hastening the death of trees primarily attacked by the pine-destroying beetle.

EXHIBIT: Work. Section of top of western yellow pine, showing galleries of adult beetles in inner bark. (Large case.)

261. The Companion Bark-Beetle (*Tomicus avulsus* Eich.).

A common species infesting pine in the Southern States. When abundant it attacks and kills healthy trees, but is especially common as a secondary enemy in company with the destructive bark-beetle *Dendroctonus frontalis* Zimm.

EXHIBIT: Adults, work.

CASE 46.

262. The Lawson Cypress Bark-Beetle (*Phlœosinus cupressi* Hopk.).

Attacks transplanted Lawson and Monterey cypress in California. It also attacks redwood.

EXHIBIT: Adults, work.

263. The Hickory Bark-Beetle (*Scolytus quadrispinosus* Say).

A common bark-beetle in hickory, frequently causing the death of trees. The adults also do some damage by gnawing the base of small twigs, causing their death.

EXHIBIT: Adults, work.

CASE 47.

264. The Mountain-Pine Dendroctonus (*Dendroctonus* n. sp.).

Attacks living, injured, and recently felled mountain or silver pine, sugar pine, and lodge-pole pine in the Northwestern States. Very common and capable of great destruction to the best timber.

EXHIBIT: Adults, work.

265. The Arizona Dendroctonus (*Dendroctonus* n. sp.).

A common bark-beetle in the southern Rocky Mountain region, attacking healthy western yellow pine, and, in company with several closely allied species, causing great destruction of large quantities of the best timber.

EXHIBIT: Adults, work.

266. The Bald Cypress Bark-Beetle (*Phlœosinus* n. sp.).

Attacks recently felled and girdled bald cypress in the Southern States.

EXHIBIT: Adults, work.

PREDACEOUS AND PARASITIC ENEMIES OF DESTRUCTIVE FOREST INSECTS. THE CLERIDS. FAMILY CLERIDÆ.

CASE 48.

267. The Dubius Clerid (*Thanasimus dubius* Fab.).

The beetles destroy the adults, and the larvæ prey upon the developing broods of many species of bark-beetles in pine and spruce, and are frequently of the greatest benefit in holding in check the more destructive of these.

EXHIBIT: Adults.

268. The Spider-like Clerid (*Clerus sphegeus* Fab.).

The adults feed upon the adults and the larvæ upon the developing broods of numerous destructive bark-beetles in pine, spruce, and fir. Western States.

EXHIBIT: Adults.

269. The European Bark-Beetle Destroyer (*Thanasimus formicarius* Linn.).

Is very destructive to bark-beetles infesting pine and spruce in Europe, and was introduced into America in 1892 to act as a check to the alarming increase of the destructive bark-beetle (*Dendroctonus frontalis*) in West Virginia.

EXHIBIT: Adults.

270. The Orange-Banded Clerid (*Clerus ichneumoneus* Fab.).

The larvæ prey upon the developing broods of the hickory bark-beetle (*Scolytus quadrispinosus*).

EXHIBIT: Adults.

271. The Hairy Clerid (*Chariessa pilosa* Forst.).

The larvæ prey upon and do much toward preventing the increase of several of the destructive flat-headed borers (*Buprestidæ*) in deciduous trees.

EXHIBIT: Adults.

THE CLICK BEETLES. FAMILY ELATERIDÆ.

272. The Eyed Elater (*Alaus oculatus* Linn.).

As a larva preys upon numerous species of bark and wood boring insects in deciduous trees.

EXHIBIT: Adults.

273. The Small-Eyed Elater (*Alaus myops* Fab.).

As a larva preys upon the larger species of borers in coniferous trees.

EXHIBIT: Adults, larva.

274. The Four-Winged Parasites (Order *Hymenoptera*. Families *Ichneumonidæ*, *Braconidæ*, *Chalcididæ*, etc.).

Exhibit: Two larval galleries of the rigid cypress borer (*Œme rigida*), in one of which the insect attained full development, while in the other it was attacked and killed by a parasite, *Bracon* sp.

Adults and cocoons of several species which attack larvæ of butterflies and moths.

Adults and cocoons of several species which attack larvæ of wood-boring insects.

THE TROGOSITIDS. FAMILY TROGOSITIDÆ.

275. The Green Trogositid (*Trogosita virescens* Fab.).

A very important enemy of nearly all the larger and more destructive bark-beetles. The adults conceal themselves in the outer bark, and the larvæ enter the galleries and prey upon the insects therein.

Exhibit: Adults.

THE COLYDIIDS. FAMILY COLYDIIDÆ.

276. The Tuberculate Colydiid (*Aulonium tuberculatum* Lec.).

The adults enter the galleries and with the larvæ feed upon various species of bark-beetles in all their stages.

Exhibit: Adults.

277. The Line-Marked Colydiid (*Colydium lineola* Say).

The adults enter the galleries and their larvæ feed upon the developing brood of various species of Ambrosia beetles.

Exhibit: Adults.

SECTION III.

SPECIAL INVESTIGATIONS.

[In connection with the exhibit of the Bureau of Forestry.]

DESTRUCTION OF PINE BY BARK-BEETLES IN THE BLACK HILLS FOREST RESERVE, SOUTH DAKOTA.

CASE 49.

278. The Pine-Destroying Beetle of the Black Hills (*Dendroctonus ponderosæ* Hopk.).

Attacks healthy pine and spruce in the Black Hills of South Dakota, and Rocky Mountain region. The adult beetles excavate characteristic galleries in the inner bark of dead, dying, and healthy trees. Their eggs are deposited along the sides of these galleries, and the larvæ developing from them mine the inner bark. Very destructive.

Exhibit: Adults, larvæ, pupæ, pitch tube on bark of living tree at entrance to gallery of adult beetle; completed galleries of adults and mines of young larvæ in bark of living pine, showing characteristic appearance of bark in August of the year of attack; surface of wood grooved by galleries of the adult, showing characteristic appearance in August of the year of attack; gallery of adult, larval mines, and pupal chambers in inner bark, showing characteristic appearance in June of the year following attack; appearance of inner bark in August of the year following attack, after the emergence of the brood; scoring chip from railroad cross-tie from tree killed by beetles, showing characteristic markings on surface of wood.

279. The Yellow-Pine Wood Engraver (*Pityogenes carinulatus* Lec.).

A secondary enemy of pine. Attacks branches and twigs of trees dying from attack of the pine-destroying beetle.

Exhibit: Adults; work of adults and larvæ in bark and surface of wood.

280. The Oregon Tomicus (*Tomicus oregoni* Eich.).

A secondary enemy of pine forests in the Black Hills, attacking the larger branches and upper portions of the trunks of trees injured by or dying from an attack of the pine-destroying beetle. Occasionally a primary enemy of living trees.

Exhibit: Adults; galleries of Oregon Tomicus and pine-destroying beetle side by side in bark of pine; work of adults in bark; groovings in surface of wood.

DESTRUCTION OF PINE FORESTS BY BARK-BEETLES IN THE SOUTHERN STATES.

CASE 50.

281. The Destructive Pine Bark-Beetle (*Dendroctonus frontalis* Zimm.).

Attacks healthy pine and spruce in the Southern States. It is capable of enormous destruction and, though usually held in check by natural causes, has at various times past so increased as to seriously menace the entire stand of pine and spruce in portions of the Southeastern States, notably in West Virginia in 1891–92.

Exhibit: Adults; markings on surface of wood of beetle-killed tree; appearance of outer bark and surface of wood of beetle-killed tree; section of trunk of pine, showing galleries of adult beetles in bark two to three weeks after first attack, surface of wood marked by galleries of adult beetles and mines of larvæ six to eight weeks after attack, outer bark of tree scaled off by woodpeckers in search of beetles and their larvæ; work of adults and larvæ in bark.

282. The Companion Bark-Beetle (*Tomicus avulsus* Eich.).

A common species infesting pine in the Southern States. When abundant it may attack and kill healthy trees, but is especially common as a secondary enemy in company with the destructive pine bark-beetle.

Exhibit: Adults; appearance of work of adults and larvæ in bark; galleries of destructive pine bark-beetle and companion bark-beetle side by side in bark of large beetle-killed tree.

DESTRUCTION OF WESTERN YELLOW PINE BY BARK-BEETLES IN THE SOUTHERN ROCKY MOUNTAIN REGION.

CASE 51.

283. The Arizona Dendroctonus (*Dendroctonus* n. sp.).

A common bark-beetle in the southern Rocky Mountain region attacking healthy western yellow pine, and in company with several closely allied species causing destruction of large quantities of the best timber.

Exhibit: Adults; work of adults and larvæ in bark.

284. The Colorado Dendroctonus (*Dendroctonus approximatus* Dietz).

Attacks recently-dead and living western yellow pine in the southern Rocky Mountain region. Often found working in the same tree and side by side with the Arizona Dendroctonus.

Exhibit: Adult; surface of wood showing marks of work; gallery of adult and mines of young larva in bark.

285. The Pine-Destroying Beetle of the Black Hills (*Dendroctonus ponderosæ* Hopk.).

Exhibit: Adults; surface of wood showing characteristic groovings; gallery of adult and mines of young larvæ in bark.

INJURY BY BARK-BEETLES TO PINE AND OTHER CONIFERS IN THE NORTHWEST.

CASE 52.

286. The Mountain Pine Dendroctonus (*Dendroctonus* n. sp.).

Attacks living, injured, and recently felled mountain or silver pine, sugar pine, and lodge-pole pine in the Northwestern States. Very common and capable of great destruction to the best timber.

EXHIBIT: Adults; work of adults and larvæ in bark; surface of wood showing characteristic marks of work.

287. The Douglas Spruce Dendroctonus (*Dendroctonus* n. sp.).

Attacks living, injured, and recently felled Douglas spruce and western larch. Rocky Mountain region and Pacific coast. Very common and capable of destroying much valuable timber.

EXHIBIT: Adults; gallery of adult and mines of young larvæ in bark; inner bark of tree showing characteristic appearance of larval mines.

288. The Redwood Bark-Beetle (*Phlœosinus sequoiæ* Hopk.).

Attacks living, injured, and recently felled redwood and giant arborvitæ. California to northern Washington. Very common in redwood.

EXHIBIT: Adults; surface of wood grooved by adult galleries and larval mines.

289. The Lawson Cypress Bark-Beetle (*Phlœosinus cupressa* Hopk.).

Attacks transplanted Lawson and Monterey cypress in California. It also attacks redwood.

EXHIBIT: Adult; section of small beetle-killed Lawson cypress, showing beginning of gallery of adult in living tree; section of small Lawson cypress showing characteristic grooves in surface of wood, and exit holes of beetles in bark; branch of Monterey cypress showing grooves in surface of wood of adult and larval galleries.

INJURIES BY AMBROSIA OR TIMBER BEETLES.

CASE 53.

290. The Apple Wood-Stainer (*Pterocyclon mali* Fitch.).

A small timber beetle first described from the apple, but attacking a great diversity of woods. It has proven very injurious to the wood of girdled cypress trees and sawed mahogany lumber. In its work in mahogany it is accompanied by the oak wood-stainer (*Pterocyclon fasciatum*), a closely allied species with similar habits.

EXHIBIT: Adults; cypress lumber showing pin-hole defects caused by adults; mahogany lumber seriously injured by the apple wood-stainer and oak wood-stainer; cross section of mahogany plank, showing single gallery of the oak wood-stainer.

291. The Pan-American Platypus (*Platypus compositus* Say).

A timber beetle causing injury to the wood of a great variety of trees and the principal cause of pin-holes in cypress. It attacks girdled trees before cutting.

EXHIBIT: Adults; cypress lumber showing injury in sapwood (pin-holes usually accompanied by staining). Cypress lumber showing injury to heartwood (pin-holes not accompanied by staining).

292. The Sugar-Cane Ambrosia Beetle (*Xyleborus* n. sp.).

An extremely common species throughout the southern United States, West Indies, and Mexico. It attacks a great variety of woods and is also an enemy of sugar-cane, excavating its galleries in living stalks.

EXHIBIT: Adult; injury to wood of cypress logs after cutting and before being sawed, showing entrance galleries on surface of wood and galleries in sapwood; injury to mahogany logs before, during, and after importation; injury to mahogany caused by entrance of beetles at end of logs.

293. The Large Mahogany Timber Beetle (*Platypus* sp.).

Attacks mahogany trees and saw logs before importation.

Exhibit: Work.

INSECTS INFESTING CYPRESS.

CASE 54.

294. The White-Lined Cypress Borer (*Physocnemum andreæ* Hald.).

Larvæ mine the inner bark and outer sapwood of cypress logs. Southern States.

Exhibit: Adults; larva; gallery; complete larval mine on surface of wood of girdled cypress tree.

295. The Rigid Cypress Borer (*Œme rigida* Say).

Larvæ mine inner bark of girdled cypress and dying cedar.

Exhibit: Adult; larva; work; larval mines in bark of girdled cypress.

296. The Bald Cypress Bark-Beetle (*Phlœosinus* n. sp.).

Attacks recently felled and girdled bald cypress in the Southern States; beneficial to girdled trees as it hastens death and causes the logs to dry more rapidly.

Exhibit: Adults; inner bark from girdled cypress, showing characteristic galleries of adults and larvæ.

297. The Cypress Sapwood Borer (*Acmæodera pulchella* Hbst.).

A white grub which mines the sapwood of girdled cypress two or three years after death, causing rapid decay.

Exhibit: Adult; larva; work.

298. The Cypress Weevil (*Eudocimus mannerheimii* Boh.).

The adults feed on the bark of bald-cypress twigs, causing their death, and the larvæ mine the inner bark of injured and recently felled trees. Southern States.

Exhibit: Adult; section from trunk of living cypress, showing partially healed-over galleries made by larvæ of this beetle which would eventually result in defects in the timber.

SECTION IV.

PHOTOGRAPHS.

Western yellow pine trees killed by the pine-destroying beetle, Black Hills, South Dakota.

Section of yellow pine tree killed by the destructive pine bark-beetle. North Carolina.

Trunk of western yellow pine killed by the Arizona Dendroctonus, showing work of beetles. New Mexico.

Western yellow-pine tree, showing injury caused by the dark-red turpentine beetle at base. New Mexico.

Monterey pine tree, showing injury of the dark-red turpentine beetle at base. California.

Hemlock trees killed in 1892 by the hemlock span-worm. State of Washington.

Trunk of hickory tree killed by the hickory bark-beetle, showing growth of white fungus following attack. Detroit, Mich.

Silver-pine trees killed by the mountain-pine Dendroctonus. Priest River Forest Reserve, Idaho. (2.)

Bark from trunk of giant arborvitæ, showing mines of the cedar bark-beetle. State of Washington.

Log of Douglas spruce, showing galleries of the Douglas spruce Dendroctonus. State of Washington.

Storm-felled Douglas spruce offering favorable conditions for the propagation of the Douglas spruce Dendroctonus and other bark-beetles. State of Washington.

Bark from storm-felled log of Douglas spruce, showing galleries of the Douglas spruce Dendroctonous. State of Washington.

Group of long-leafed pine killed by so-called "worm deadening." Eastern Texas.

Young Sitka spruce, showing top killed by western spruce-weevil. State of Washington.

Cottonwood tree killed by the bronzed Agrilus, showing the galleries of larvæ in trunk. Priest River Forest Reserve, Idaho.

Young chestnut killed by the two-lined chestnut borer. Western North Carolina.

Large chestnut, the death of which was hastened by insect injury. Western North Carolina.

Girdled cypress tree injured by timber beetles. South Carolina.

Trunk of hickory killed by hickory bark-beetle, showing galleries on surface of wood. Western North Carolina.

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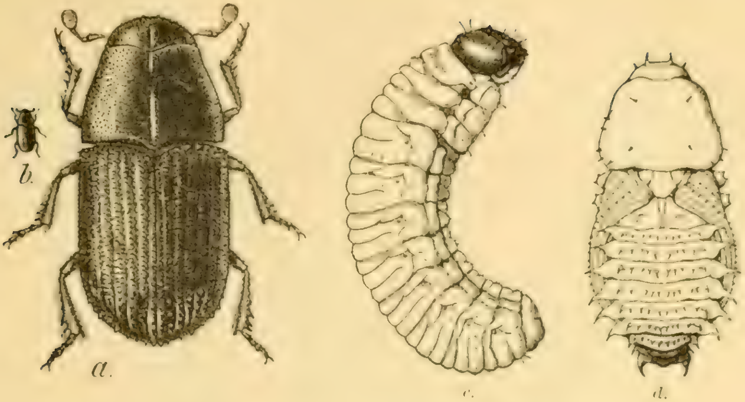


FIG. 1.—THE PINE-DESTROYING BEETLE OF THE BLACK HILLS.

a, Adult beetle, enlarged; *b*, adult beetle, natural size; *c*, larva; *d*, pupa.

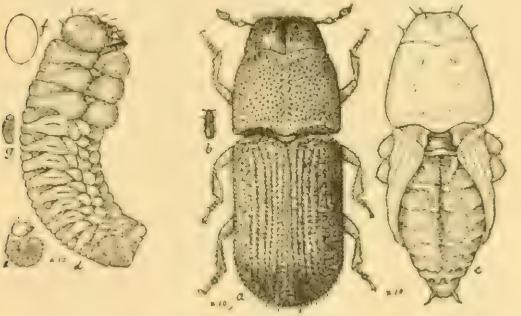


FIG. 2.—DESTRUCTIVE PINE BARK-BEETLE.

a, Adult beetle, enlarged; *b*, adult, natural size; *c*, pupa, enlarged; *d*, larva, enlarged; *e*, young larva, enlarged; *f*, egg, enlarged; *g*, larva, natural size. (After author, in Bulletin No. 56, West Virginia experiment station.)

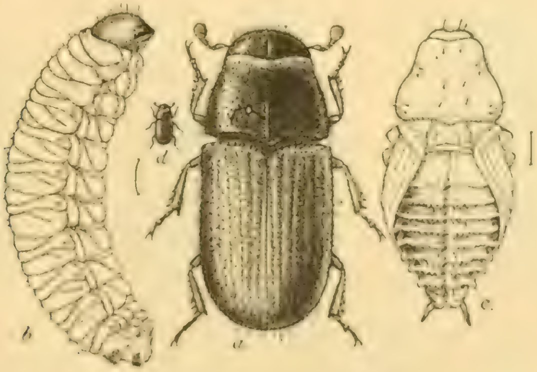


FIG. 3.—SPRUCE-DESTROYING BEETLE.

a, Dorsal view of adult beetle; *b*, side view of larva; *c*, dorsal view of pupa—all greatly enlarged; *d*, natural size of beetle.

(From Yearbook, U. S. Dept. Agriculture, 1902.)

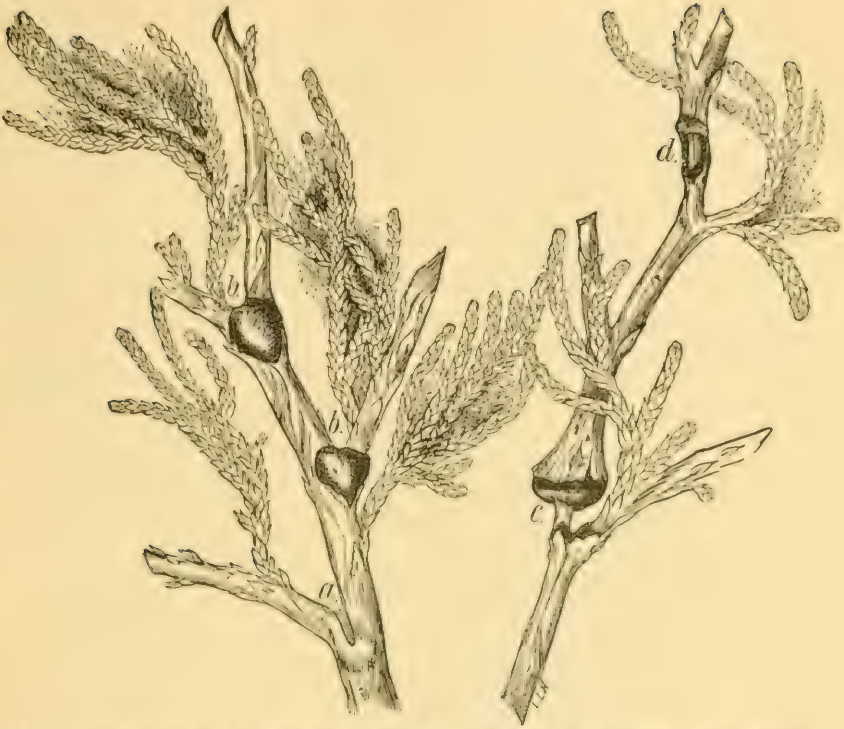


FIG. 1.—WORK OF THE LAWSON'S CYPRESS BARK-BEETLE IN TWIGS OF LIVING TREES.
a, Burrows at base of twig; *b*, *b*, wounds covered with gum; *c*, deformed twig; *d*, wound where twig has died and fallen

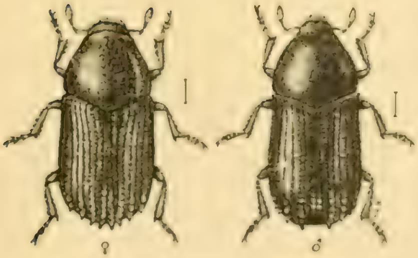


FIG. 2.—THE LAWSON'S CYPRESS BARK-BEETLE: ADULTS, MALE AND FEMALE.

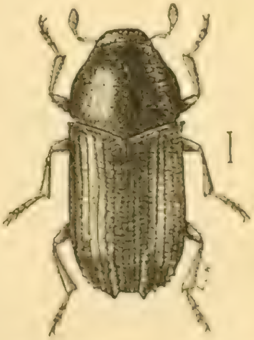
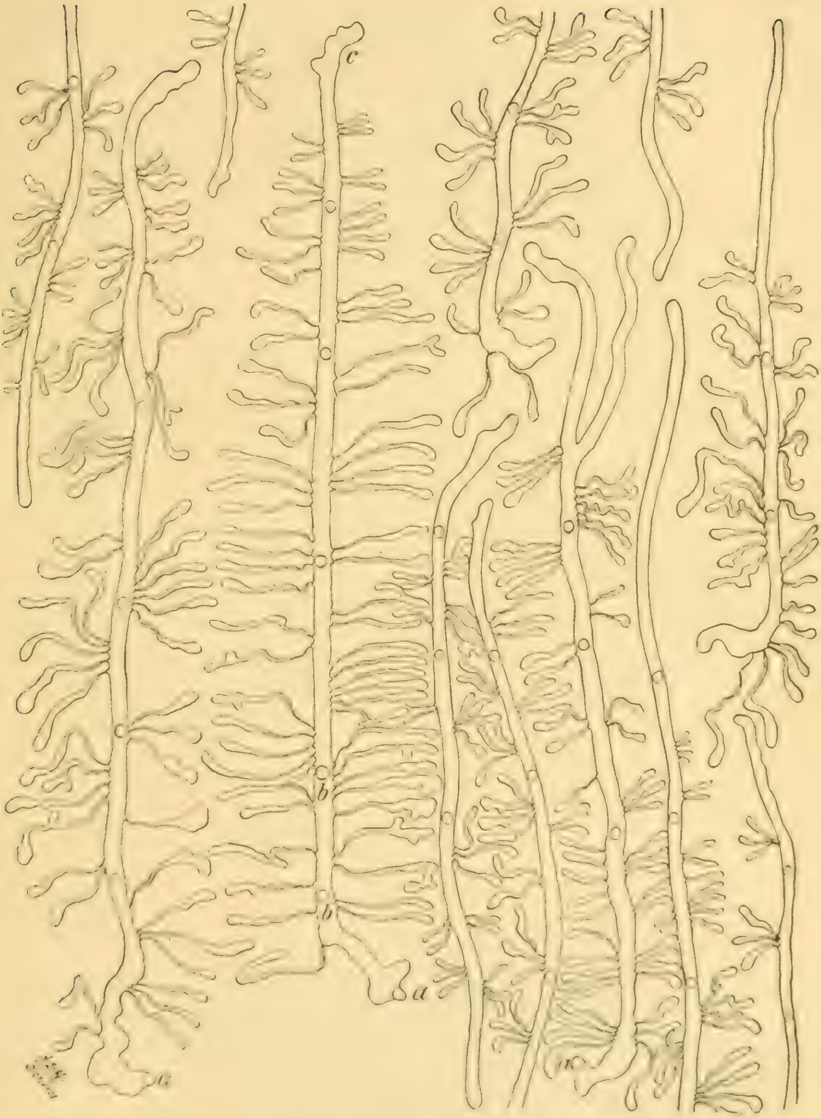


FIG. 3.—THE REDWOOD BARK-BEETLE (PHLŒOSINUS SEQUOIÆ HOPK.): ADULT, ENLARGED.

(From Bul. 38, Bureau of Forestry, U. S. Dept. of Agriculture.)

PLATE III.



WORK OF THE PINE-DESTROYING BEETLE OF THE BLACK HILLS. PRIMARY GALLERIES AND LARVAL MINES IN INNER SURFACE OF LIVING BARK.

a, Entrance and basal chamber; *b*, ventilating holes in roof of gallery; *c*, termination. The larval mines radiate from the primary galleries. About one-half natural size. (Author's illustration, Bul. 32, n. s., Div. of Entomology, U. S. Dept. of Agriculture.)

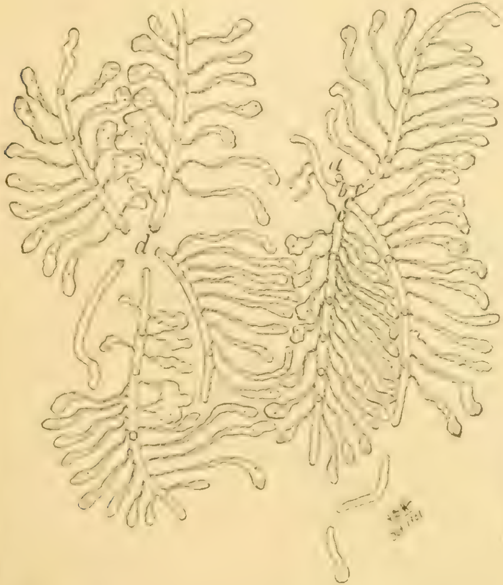


FIG. 1.—WORK OF THE OREGON TOMICUS (TOMICUS OREGONI EICHH.). PRIMARY GALLERIES AND LARVAL MINES IN INNER BARK.

a, Entrance; *b*, central chamber excavated through inner bark; *c*, egg galleries; *d*, location of central chamber not excavated through inner bark. Reduced about one-half. (Original.)

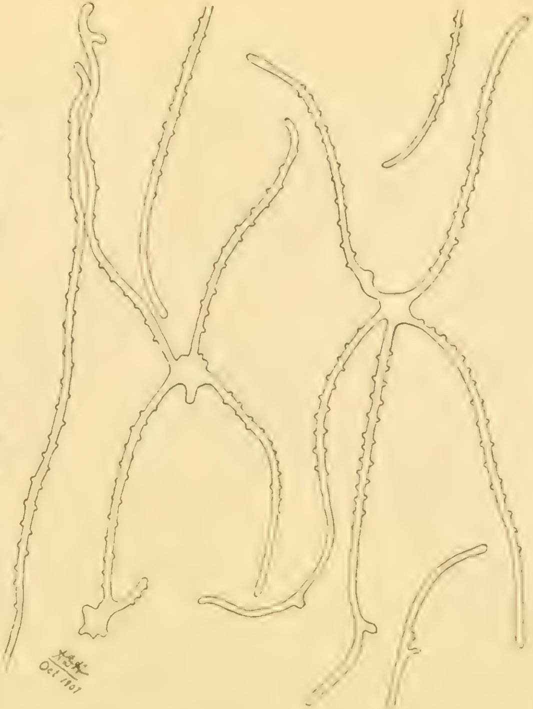


FIG. 2.—WORK OF THE OREGON TOMICUS. PRIMARY GALLERIES ENGRAVED IN SURFACE OF WOOD.

Central chamber extending into wood. Reduced about one-half. (Original.)

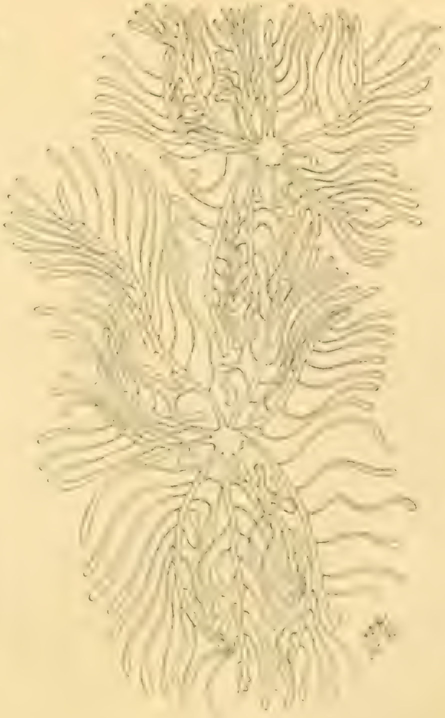
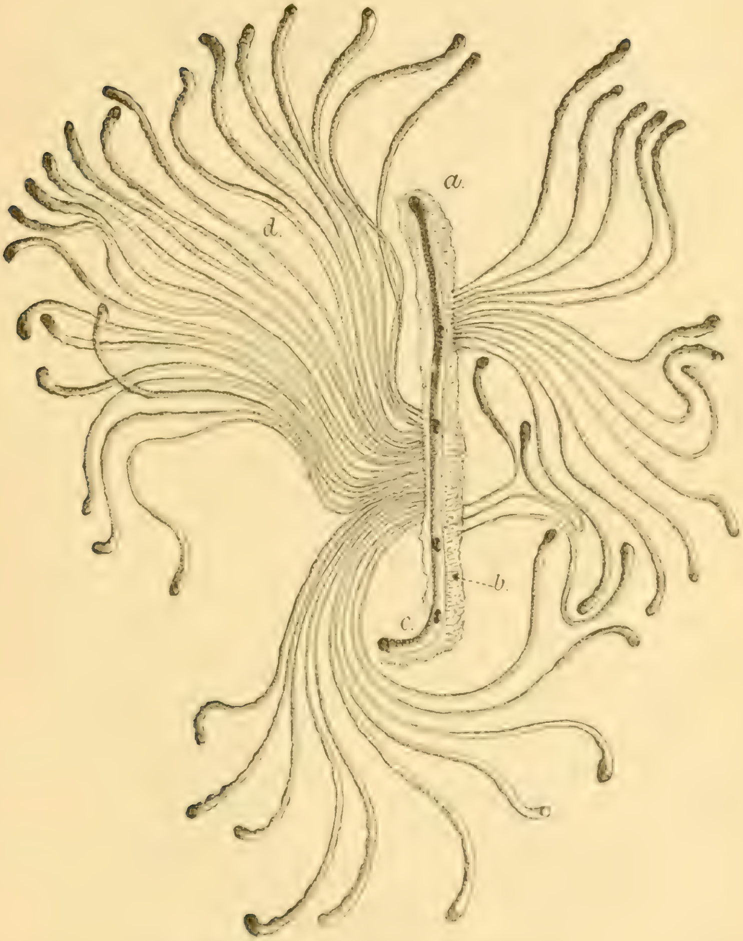


FIG. 3.—WORK OF THE YELLOW PINE WOOD ENGRAVER. PRIMARY GALLERIES AND LARVAL MINES IN INNER BARK AND SURFACE OF WOOD.

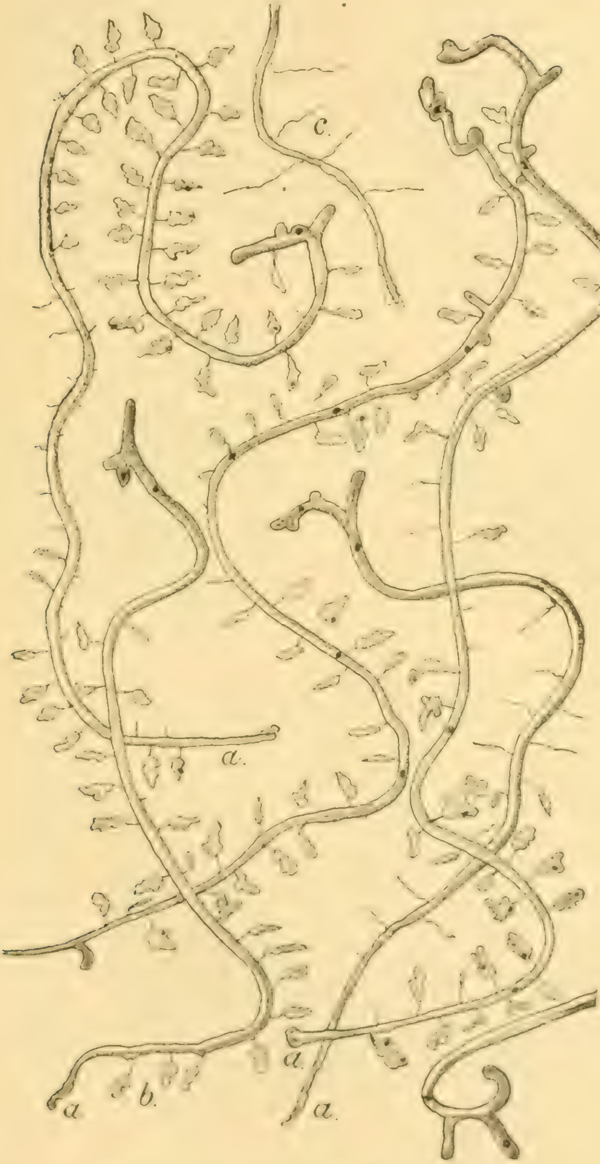
Reduced about one-half. (Original).

(Author's illustrations, Bul. 32, n. s., Div. of Entomology, U. S. Dept. of Agriculture.)



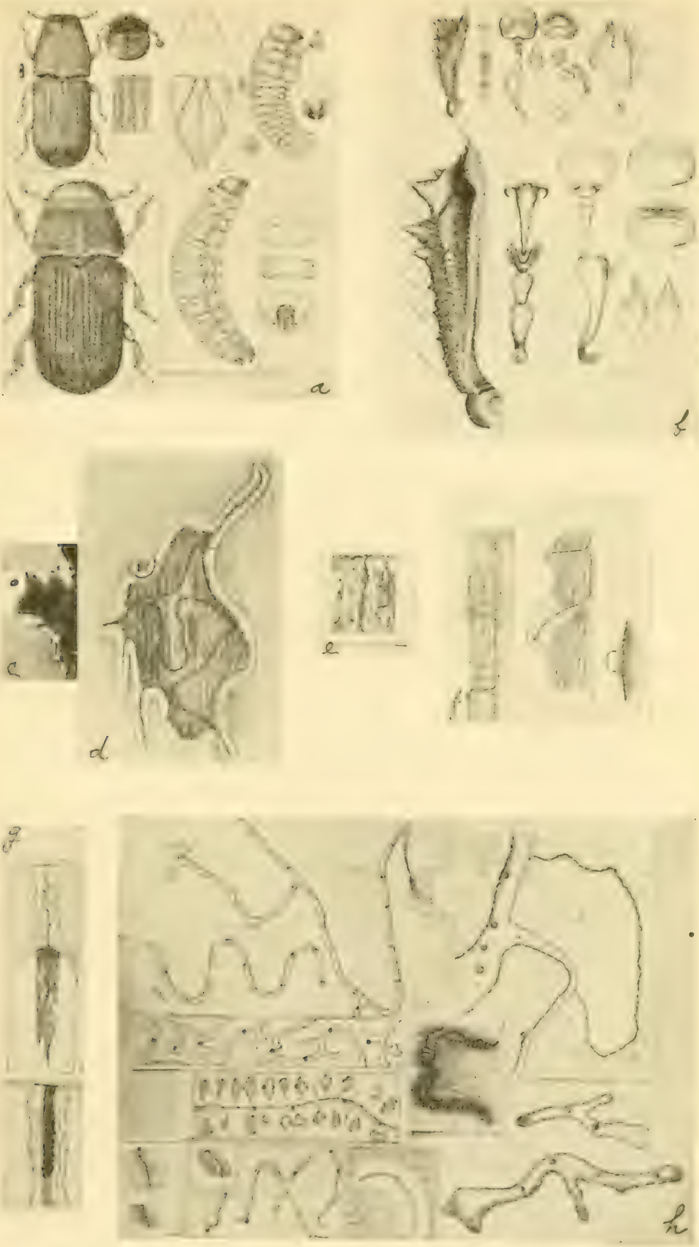
WORK OF THE SPRUCE-DESTROYING BEETLE.

a, Primary gallery; *b*, borings packed in side; *c*, entrance and central burrow through the packed borings; *d*, larval mines. (From Yearbook, U. S. Dept. of Agriculture, 1902.)



WORK OF DESTRUCTIVE PINE BARK-BEETLE.

a, a, a, a, Characteristic forms of primary galleries; *b*, normal forms of larval mines; *c*, abnormal forms of larval mines—all slightly reduced. (Author's illustration, Yearbook, U. S. Dept. of Agriculture, 1902.)



WORK OF DENDROCTONUS FRONTALIS AND DENDROCTONUS TEREBRANS.

a. *Dendroctonus frontalis*: *A*, adult; *B*, pupa; *C*, larva; *D*, adult of *D. valens*; *E*, larva.—*b*. *D. frontalis*: *A*, tibia; *B*, tarsus; *C*, *D*, *E*, antennæ; *F*, *G*, mouth parts. *D. valens*: *H*, Tibia; *I*, tarsus; *J*, *K*, *L*, *M*, *N*, antennæ, all enlarged.—*c*. Pitch tube made by *D. frontalis*, natural size.—*d*. Healing wounds, from living pine tree, made by *D. frontalis*, reduced.—*e*. Pupa cases of *D. frontalis* in outer pine bark.—*f*. *D. frontalis*: *A*, *B*, Longitudinal section of primary galleries; *C*, egg in egg cavity inside of gallery, the latter enlarged, others reduced.—*g*. Healing wounds in living tree: *E*, *D. frontalis*; *F*, *D. valens*.—*h*. Work of *D. frontalis* in pine bark is shown at *A*, *C*, *D*, *E*, *F*, *G*; work of *D. terebrans* in pine bark at *B*, *H*, *I*; larva at work at *H*. Both *D. frontalis* and *D. terebrans* attack spruce. (From Bul. 28, n. s., Div. of Entomology, U. S. Dept. of Agriculture.)

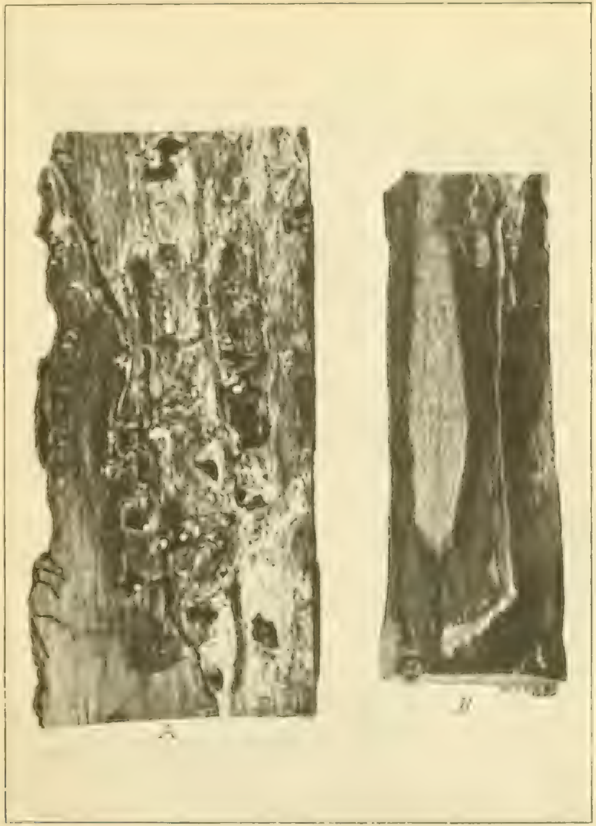


Fig. 1.

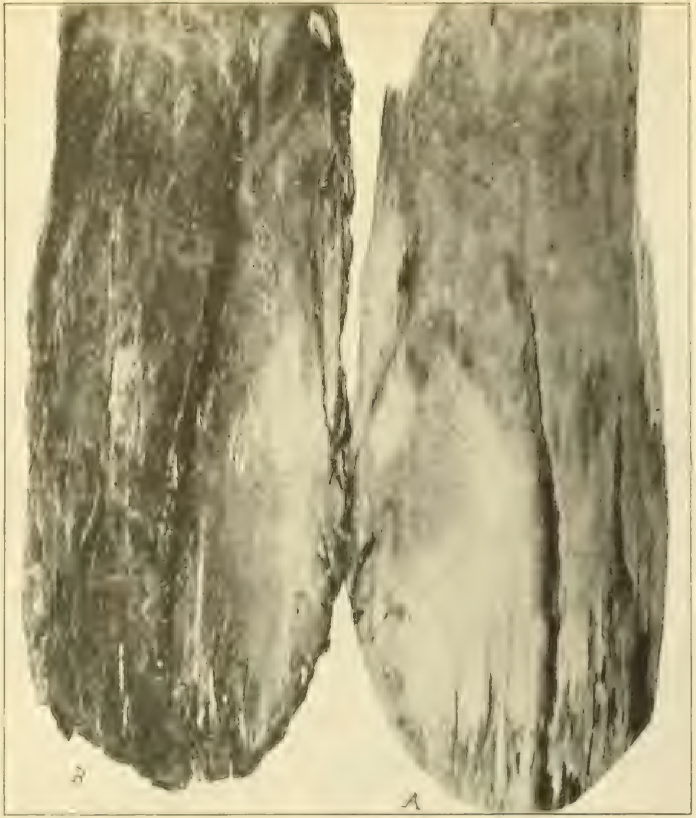


Fig. 2.

WORK OF THE PINE-DESTROYING BEETLE OF THE BLACK HILLS.

FIG. 1.—A, Primary galleries, larval mines, pupa cases, and exit holes in bark; B, primary galleries grooved in surface of wood in chip cut from railroad tie (original). FIG. 2.—A, sample chip from railroad tie, showing surface of wood not marked by insects; B, inner surface of bark from same chip. About one-third natural size. (Author's illustration, Bull. 32, n. s. Div. of Entomology, U. S. Dept. of Agriculture.)

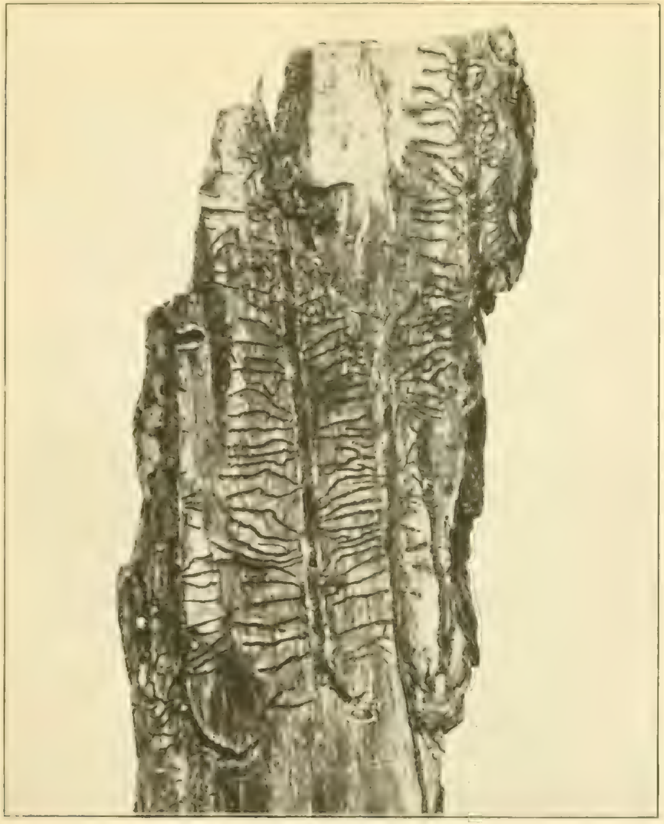


Fig. 1.

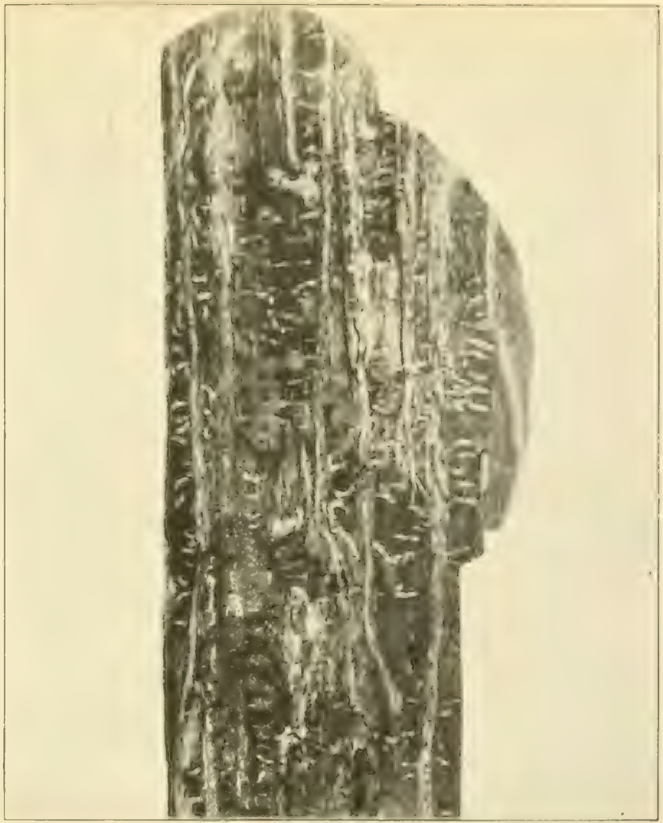


Fig. 2.

WORK OF THE PINE-DESTROYING BEETLE IN THE BLACK HILLS.

Fig. 1. Primary galleries and larval mines in inner bark. About one-third natural size. (Original.)—Fig. 2. Marks of primary galleries on surface of scoring chip from railroad tie. About one-third natural size. (Author's illustration, Bul. 32, n. s., Div. of Entomology, U. S. Dept. of Agriculture.)

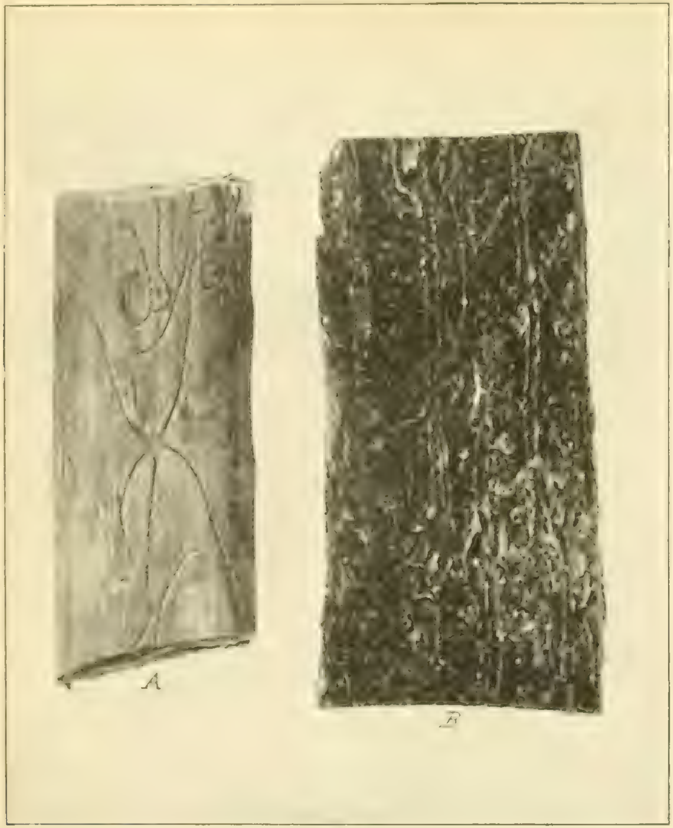


Fig. 1.

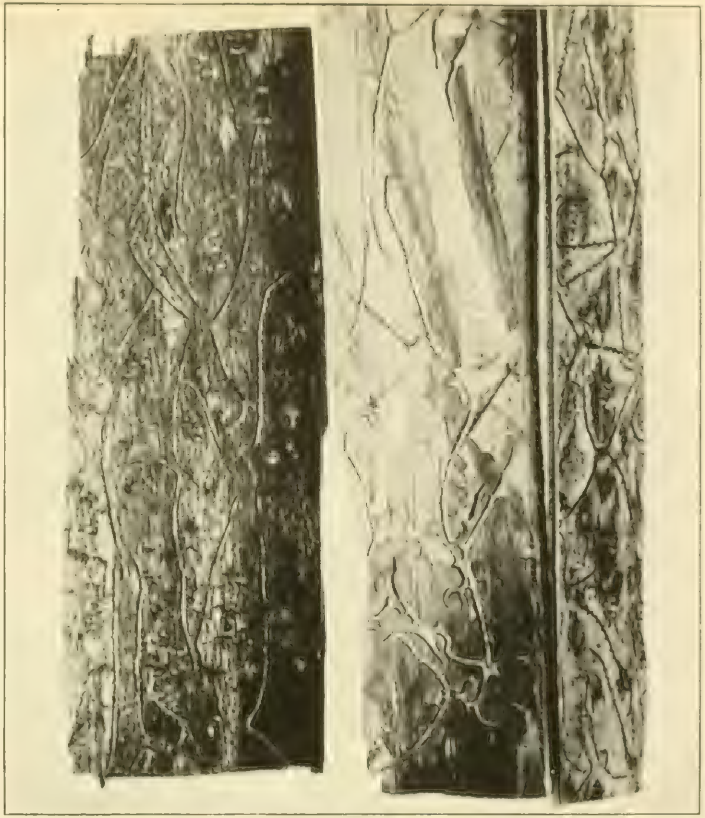


Fig. 2.

WORK OF THE OREGON TOMICUS.

Fig. 1.—A, Galleries engraved on surface of wood cut from old dead tree; B, bark with inner portion destroyed by galleries and larval mines. About one-third natural size. Fig. 2.—Galleries in inner bark and surface of wood of railroad ties and edging strips. About one-third natural size. (Author's illustration, Bul. 32, n. s., Div. of Entomology, U. S. Dept. of Agriculture.)

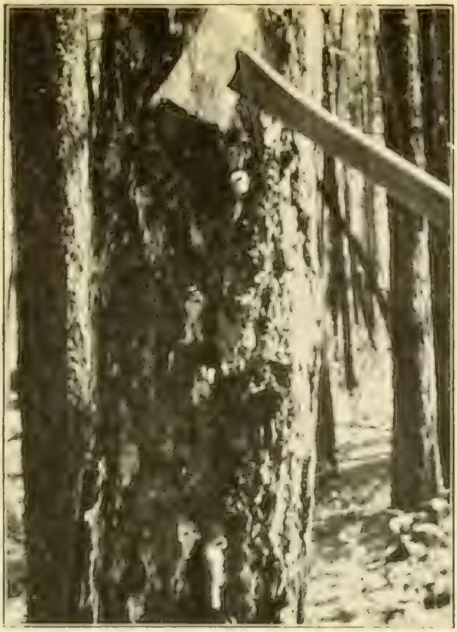


Fig. 1.

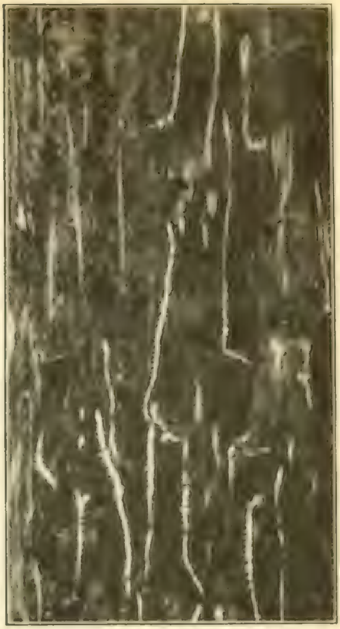


Fig. 2.

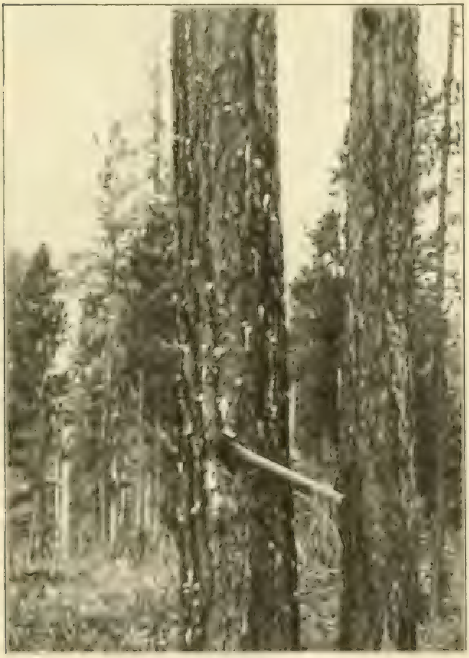


Fig. 3.

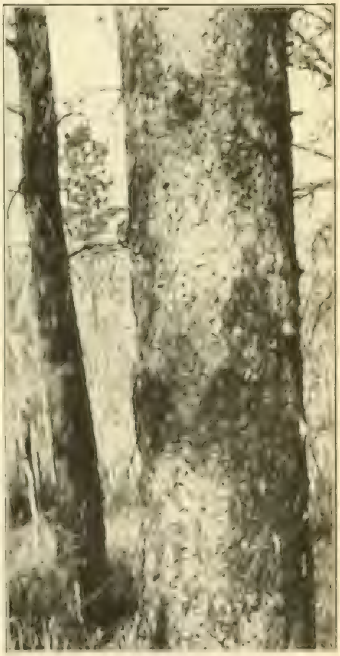


Fig. 4.

WORK OF THE PINE DESTROYING BEETLE OF THE BLACK HILLS FOREST RESERVE.

Fig. 1. Small freshly attacked tree [illegible] pitch tubes.—Fig. 2. Marks of primary galleries on the surface of wood when bark is removed.—Fig. 3. Recently attacked tree showing pitch tubes. [illegible]—Fig. 4. Dead tree [illegible] by woodpeckers. (From Bul. 32 n. s. Div. of Entomology, U. S. Dept. of Agriculture.)

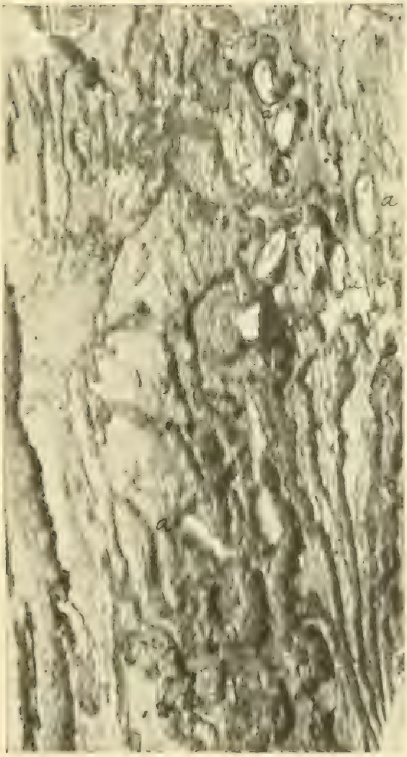


FIG. 1.—COCOONS OF BRACON SIMPLEX, A PARASITE OF THE SPRUCE-DESTROYING BEETLE.

The cocoons of *Bracon simplex*, in the larval mines of *Dendroctonus piceaperda*, are shown at *a*. (From Bul 28, n. s., Div. of Entomology, U. S. Dept. of Agriculture.)

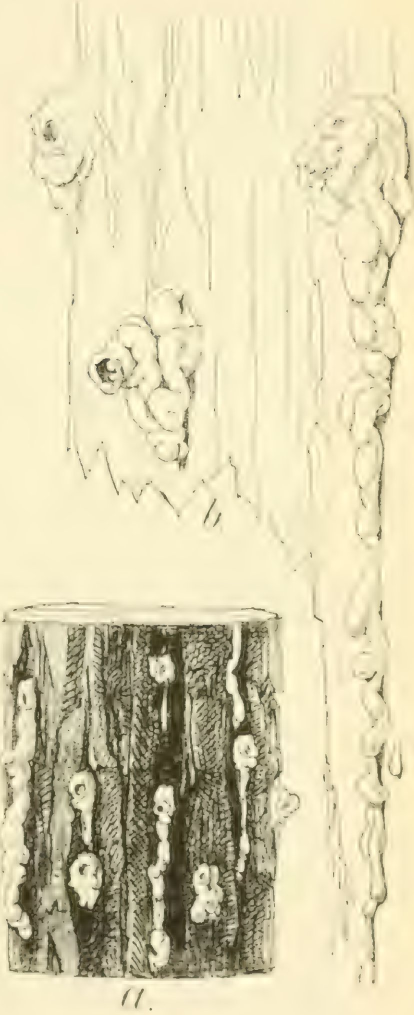
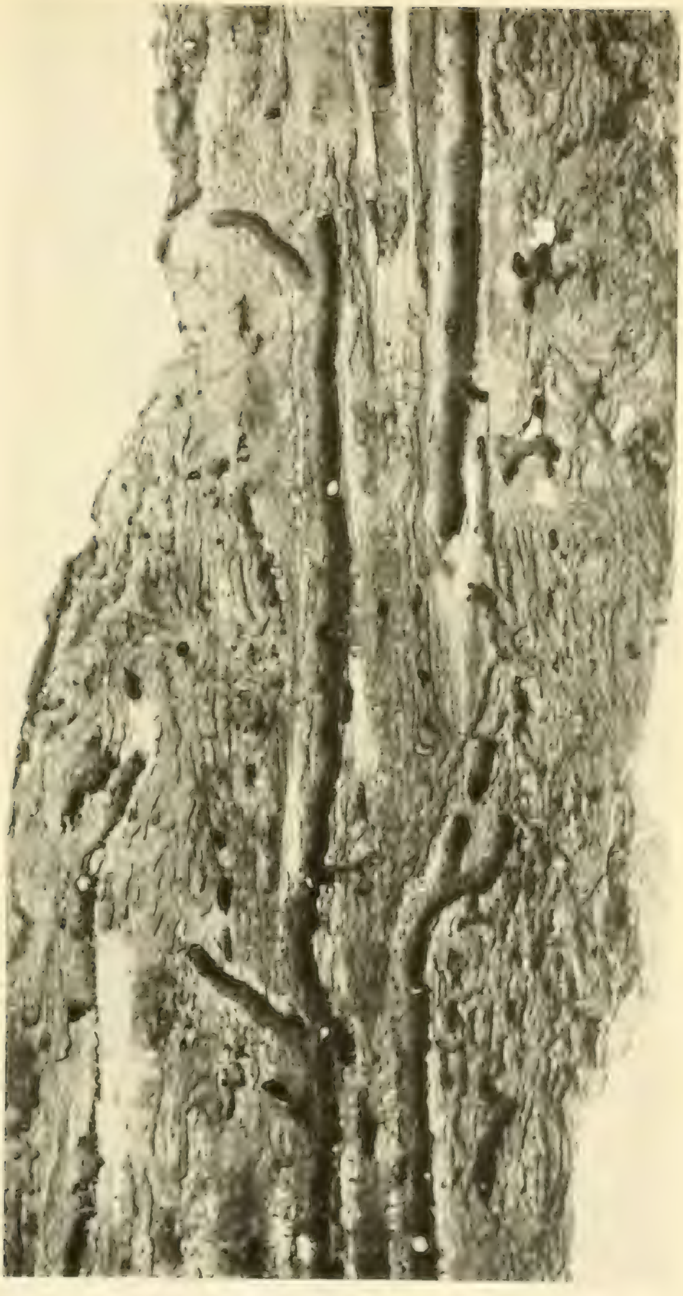


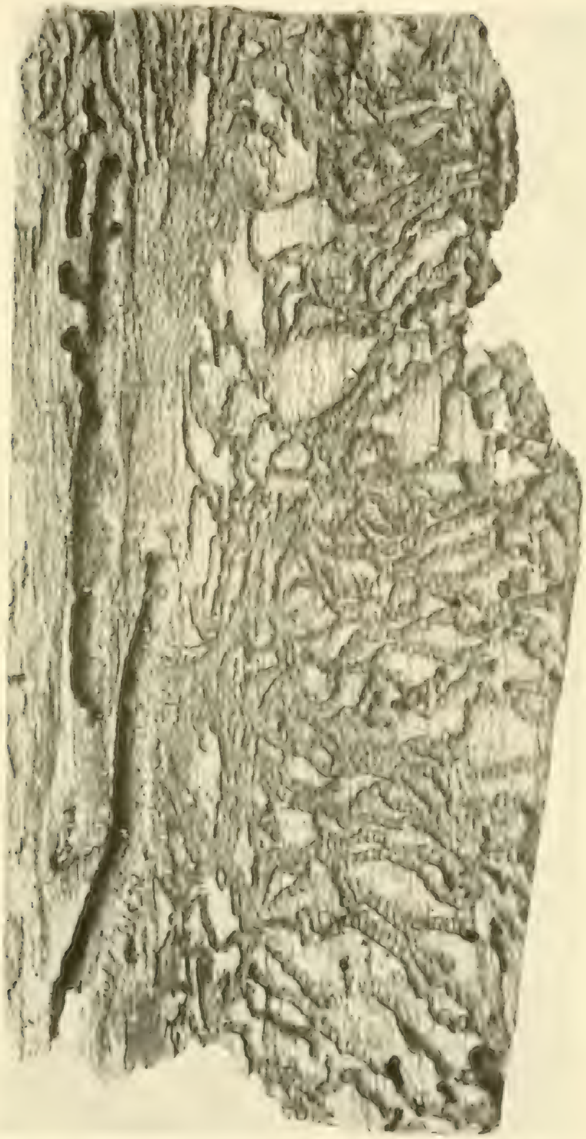
FIG. 2.—WORK OF THE PINE-DESTROYING BEETLE OF THE BLACK HILLS

a, Pitch tubes on surface of bark, much reduced; *b*, same, two-thirds natural size (From Yearbook, U. S. Dept. of Agriculture, 1902.)



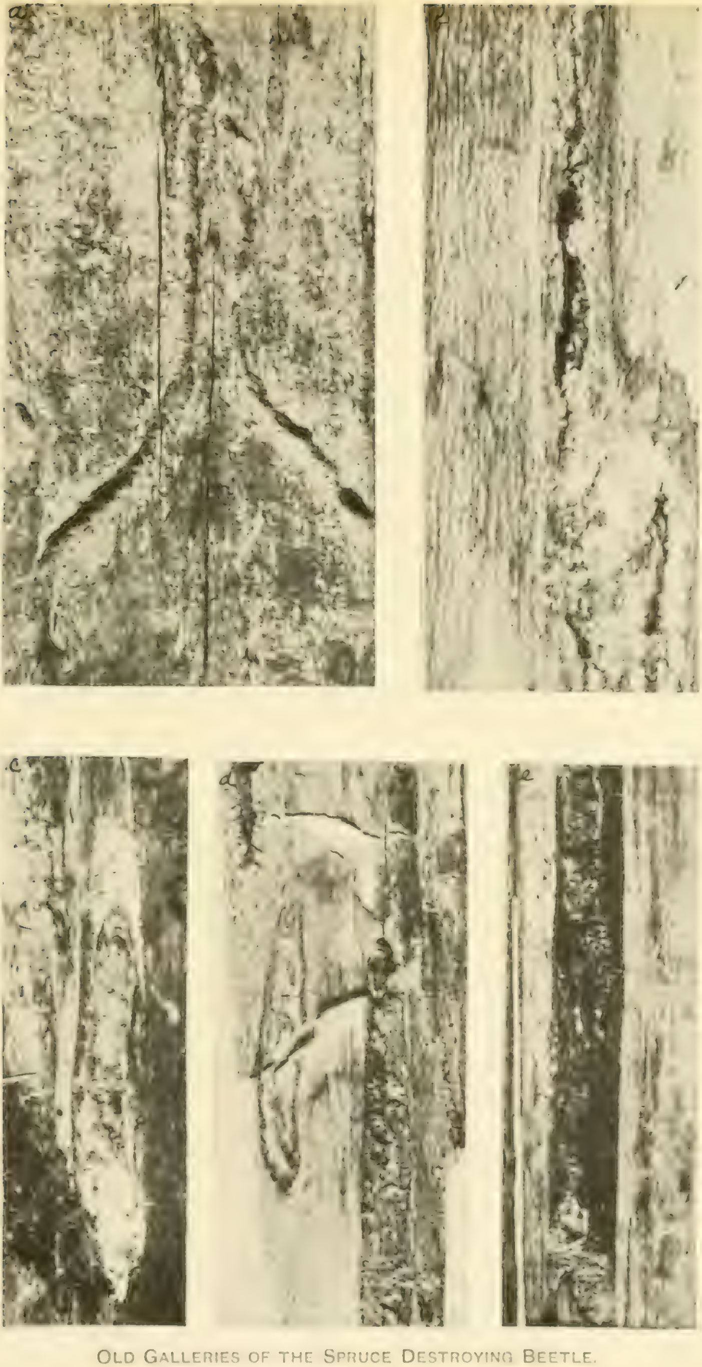
GALLERIES AND MINES OF THE SPRUCE-DESTROYING BEETLE.

Showing parts of six primary galleries reduced about one-third. (From Bul. 28, n. s., Div. of Entomology, U. S. Dept. of Agriculture.)



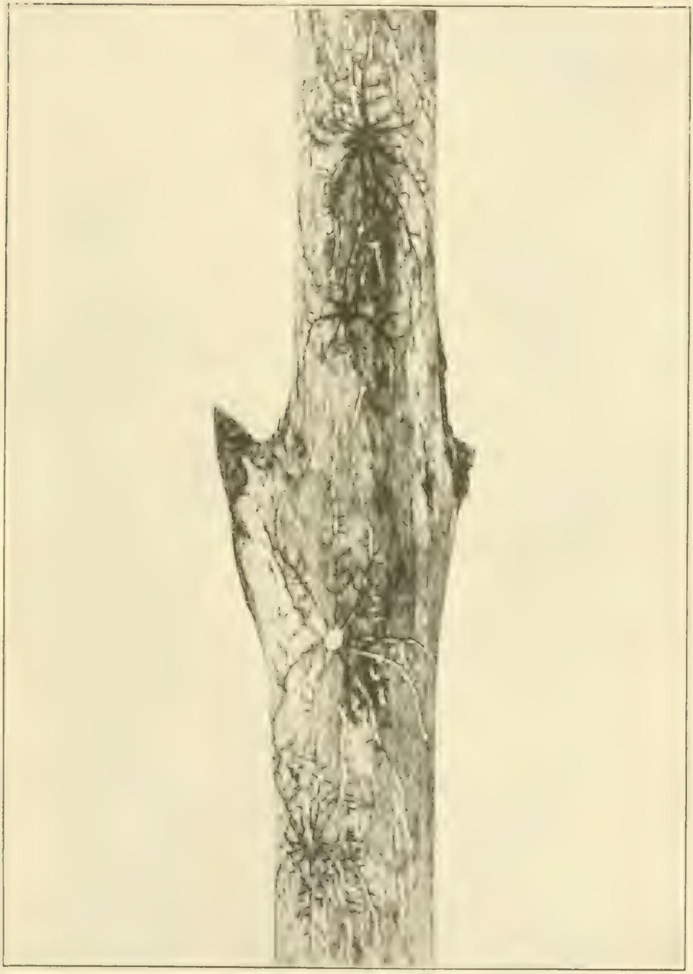
GALLERIES AND MINES OF THE SPRUCE DESTROYING BEETLE.

(From Bul. 28, n. s., Div. of Entomology, U. S. Dept. of Agriculture.)



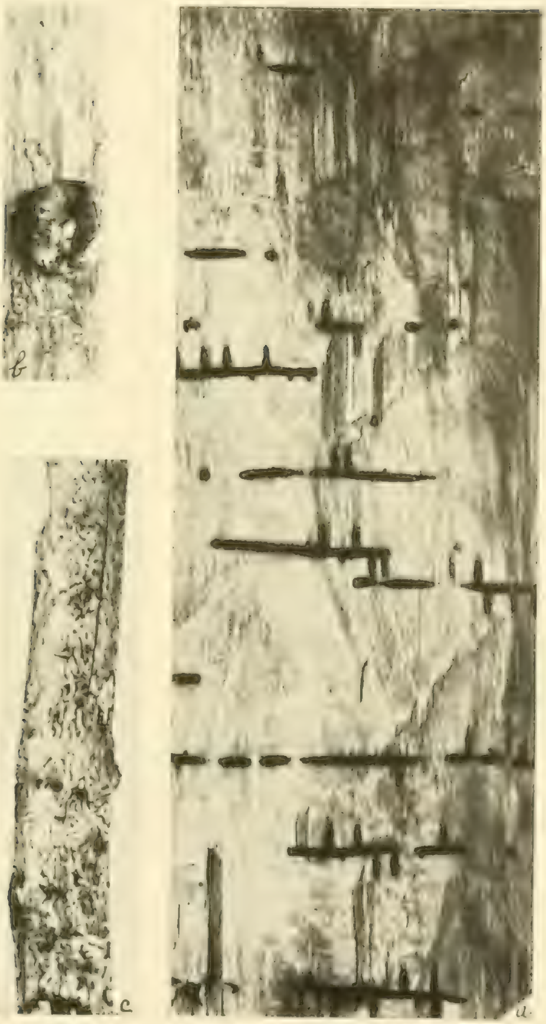
OLD GALLERIES OF THE SPRUCE DESTROYING BEETLE.

a, Grooves on the surface of the wood of a tree [illegible]; b, example of incomplete galleries, in bark of living tree, [illegible] with pitch; c, from dead [illegible], [illegible] living [illegible] were healing; e, from old dead tree [illegible]. From Bul. [illegible] U. S. Div. of Entomology, U. S. Dept. of Agriculture.



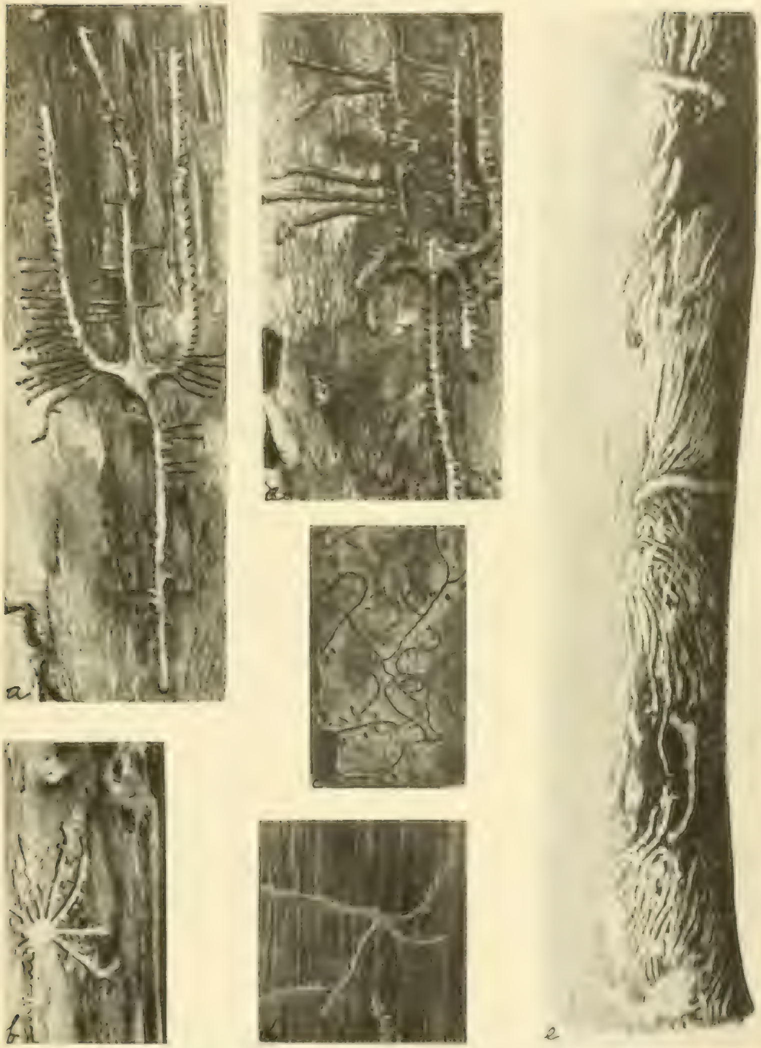
WORK OF THE YELLOW PINE WOOD ENGRAVER. GALLERIES IN INNER BARK AND SURFACE OF WOOD.

About one-third natural size. (Author's illustration, Bul. 32, n. s., Div. of Entomology, U. S. Dept. of Agriculture.)



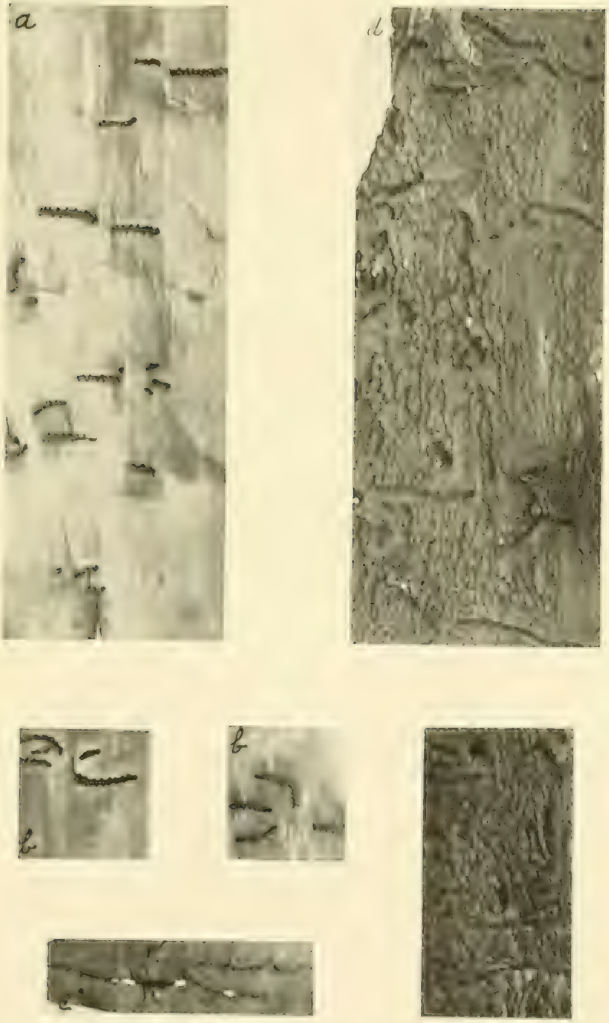
WORK OF TIMBER AND BARK-BEETLES IN SPRUCE

a, Work of the spruce timber-beetle in the sapwood of spruce, natural size; *b*, fungus (*Polyporus volvatus*) growing from mines of spruce timber-beetle on the surface of the wood after the bark had been removed, natural size; *c*, work of *[illegible]* Hopk., [illegible]. (From Bul. 28, n. s., Div. of Entomology, U. S. Dept. of Agriculture.)



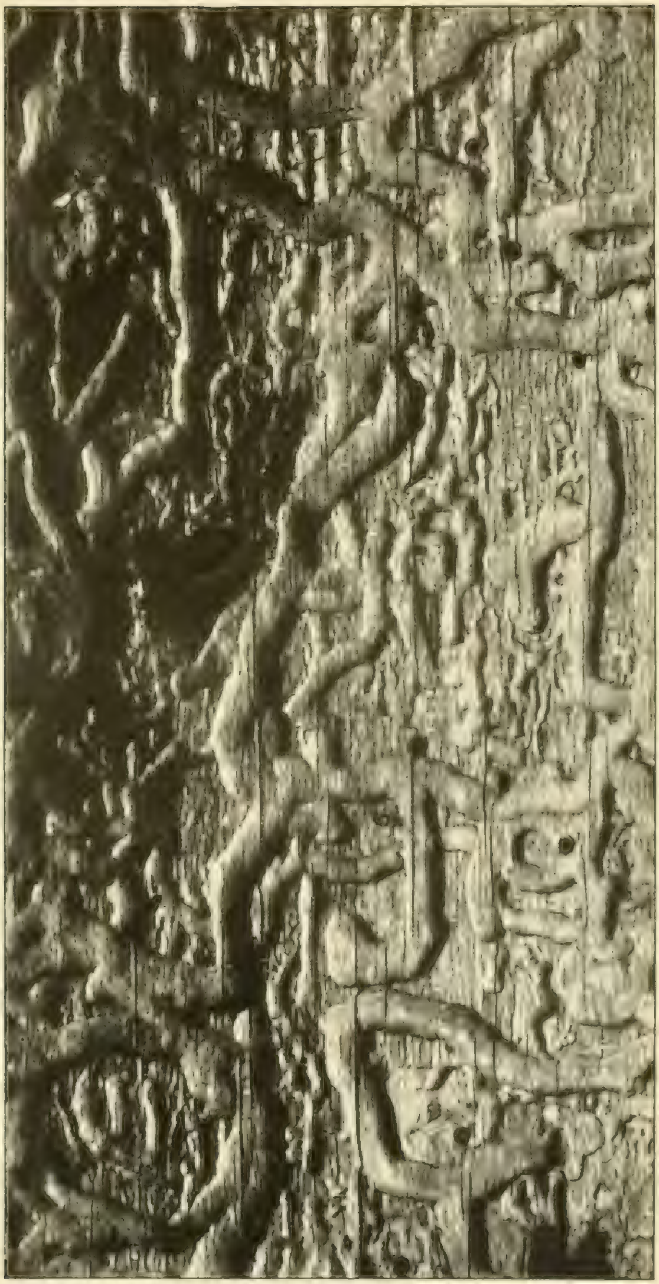
WORK OF SECONDARY AND OTHER ENEMIES OF SPRUCE.

a, Work of the white spruce bark-beetle (*Tomicus*) in white spruce bark; *b*, work of spruce wood-engraver (*Pityophthorus carinieeps* Lec.) in spruce bark and grooving the outer wood; *c*, galleries of the destructive pine bark-beetle (*Dendroctonus frontalis*) in pine bark; also attacks spruce; *d*, work of the small red spruce bark-beetle (*Dryocoetes* n. sp.) on the surface of spruce wood; *e*, galleries of the spruce bark-beetle (*D* [illegible] *pennis* Kirby) on surface of pieces of spruce driftwood, found in Parmacheene Lake. (From Bul. 28, n. s., Div. of Entomology, U. S. Dept. of Agri[illegible]



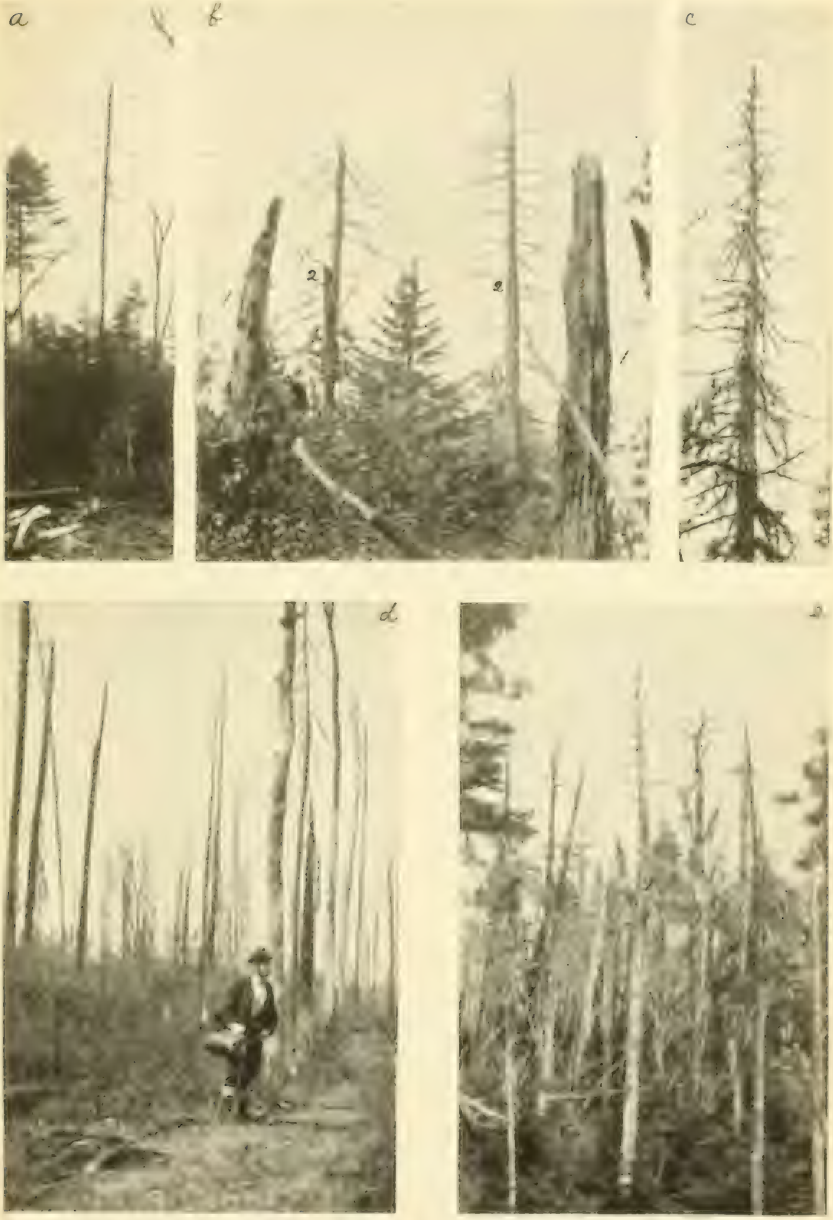
GALLERIES OF THE SPRUCE BARK-BEETLE, SHOWING DIFFERENT STAGES.

a, b, c, Freshly excavated galleries in living bark; *d*, old galleries in dead bark. (From Bul. 28, n. s., Div. of Entomology, U. S. Dept. of Agriculture



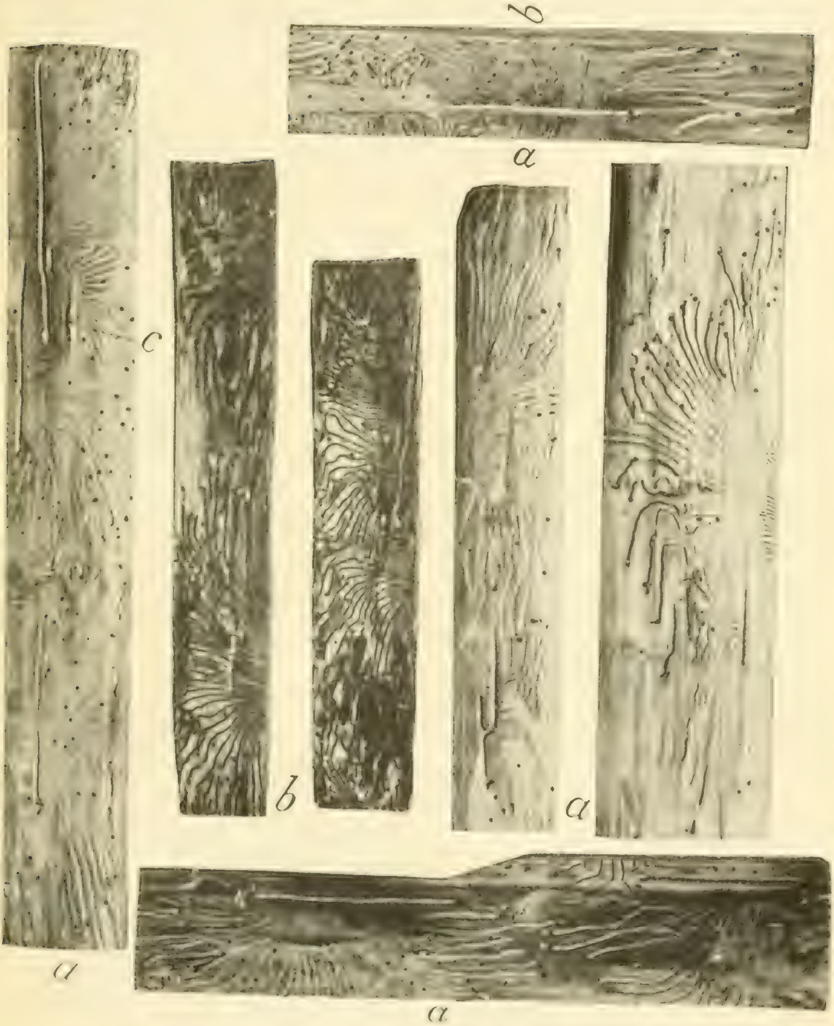
MINES OF THE DESTRUCTIVE SPRUCE WOOD-BORER.

Surface of the wood of a "peeled" and felled spruce, showing mines, natural size. (From Bull. 48, n. s., Div. of Entomology, U. S. Dept. of Agriculture.)



DEAD SPRUCE; ALSO FIR AND BIRCH.

a, Old dead spruce and a dead birch in cutting; *b1*, remains of very old dead spruce; *b2*, appearance of spruce tree after it has been dead five to ten years or more; *c*, white spruce, dead three or four years; *d*, dead spruce, fir, and birch, killed by fire; *e*, dead spruce and fir on summit of Rump Mountain, Maine. (From Bul. 28, n. s., Div. of Entomology, U. S. Dept. of Agriculture.)



WORK OF THE REDWOOD BARK-BEETLE.

a, Surface of wood grooved by primary galleries and larval mines; *b*, bark with galleries and mines through inner layer [illegible]. From Bul. 38, Bureau of Forestry, U. S. Dept. of Agriculture.

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